A Study to Determine the Effectiveness of Chiropractic Manipulative Therapy of the Sacroiliac Joint and Pelvic Stabilisation Exercises in the Management of Post-Partum Lower Back Pain

A dissertation submitted in partial fulfilment of the requirements for the Master's Degree in Technology: Chiropractic
University of Johannesburg

By

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Declaration

I, Marié Jane Rosenberg, do hereby declare that this dissertation is a representation of my own work, except where otherwise stated in the text.

Signature of Candidate: _____

On this _____day of _____2005

University of Johannesburg Representative:
Dr M. Moodley [M.Tech Chiro, S.A.]: _____
Date: _____

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Abstract

This study compared the effectiveness of three different Chiropractic treatment protocols in the treatment of post-partum low back pain. This was done in order to establish whether or not a combined treatment of Chiropractic Manipulative Therapy (CMT) of the sacroiliac joint combined with slow dynamic strengthening exercises to strengthen and stabilise the pelvis is a more effective treatment than CMT of the sacroiliac joint alone, or slow dynamic strengthening exercises in isolation.

Thirty participants were used for this study. They were randomly placed into one of three groups namely; group 1, group 2 and group 3. Group 1 received CMT solely to the involved sacroiliac joint. Group 2 received slow dynamic strengthening exercises of gluteus medius, piriformis and psoas muscles. These exercises were designed to strengthen and stabilise the pelvis. Group 3 received a combination of the above two treatments.
Six treatments were administered over a period of three weeks with each participant receiving two treatments per week.

Prior to the commencement of treatments one, three and six; each participant was objectively measured for forward flexion range of motion using the Modified Schober's test. The subjective measurements used in this study were the Numerical Pain Rating Scale and the Oswestry Lower Back Pain and Disability Questionnaire, these were also completed prior to first, third and sixth treatments.

All the collected data was statistically analysed using the one-way Anova test, the Scheffe Multiple Comparisons test and the Paired-t test.

This statistical analysis revealed statistical differences on intra-group analysis, for all the three groups involved, mostly between treatment three and treatment six for both the objective and subjective measurements. On inter-group analysis no statistical differences were found although group three subjective and objective measurements improved by a larger percentage than both group one and group two.

It was thus concluded that a combined treatment of CMT and slow dynamic strengthening exercises of gluteus medius, piriformis and psoas muscles was the most effective protocol to use on women with post-partum low back pain.

Dedication

I dedicate this body of work to my parents Kathleen and Keith for all their support over the years. Their constant love and guidance has helped me achieve my goals.

I also dedicate this work to my husband, Dale who without his love, support and computer skills this dissertation would not have been possible.

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Chapter 1: Introduction

1.1. Introduction

Low back pain is a multifaceted problem and currently no singular treatment protocol has been successful in the prevention and management of this condition (G. A. Jull, V. Janda; 1987).

The sacroiliac joint appears to be the single greatest cause of back pain. Although the range of motion of the joint is small, and may be difficult to describe, pain may occur when normal joint play is lost (D. Chapman-Smith; 1990).

It has been hypothesized that a small amount of dysfunction in the sacroiliac joint leads to pain (W. H. Kirkaldy-Willis, T. N. Bernard, Jr; 1999).

Checking motion palpation for sacroiliac joint dysfunction and specific chiropractic adjustments to restore function to the joint; have for many years been a focus of chiropractic management of low back pain (D. Chapman-Smith; 1990).

It must also be noted that increased biomechanical strain or altered hormonal influences, during pregnancy, are feasible causes for post-partum-low back pain (J.M.A. Mens; 2000).

Low back and pelvic pain occurs in approximately three quarters of pregnant women usually in the third trimester, but could also occur in the first trimester, and can continue after delivery. This pain occurs in the sacroiliac joints and the symphysis pubis (M. Forrester; 2003).

During pregnancy the hormone relaxin, is secreted by the ovaries primarily in the first trimester. Relaxin’s primary effect is the relaxation of the sacroiliac joint ligaments resulting in instability of the sacroiliac joint.

This instability leads to aberrant joint motion which leads to pain (M.L. Gatterman; 1990).

Three groups, of ten patients each, will be studied. Group one will receive Chiropractic Manipulative Therapy (C.M.T.) of the sacroiliac joints only, group two will receive dynamic stabilisation exercises of the pelvis only, while group three will receive a combination of the treatments used in group one and group two. All three groups will receive a six treatment protocol over a period of three weeks with two treatments per week. Objective data will be collected on visit one, visit three and visit six using the Modified Schober's test. Subjective data will be collected on visit one, visit three and visit six using the Numerical Pain Rating Scale and the Oswestry Low Back Pain and Disability Questionnaire.

The primary aim of this study is to determine if manipulation of the sacroiliac joints alone or in conjunction with stability exercises, designed at stabilising the pelvis, caused a decrease in pain in individuals with post-partum low back pain.

The literature review that follows will explain the anatomical correlation between the pelvic musculature and sacroiliac joints. The literature review will also describe the biomechanical dysfunction and hormonal involvement in the aetiology of post-partum low back pain. In addition the benefits and effects of the chiropractic manipulation will be evaluated.

Chapter 2: Literature Review

2.1. Ligamentous Changes in the Sacroiliac Joints During Pregnancy

Relaxin is a polypeptide hormone which is released during the first trimester of pregnancy. It is produced in the corpus luteum of the ovaries. This hormone causes fluid retention within the ligamentous connective tissue and results in relaxation of the pelvic ligaments (M. Forrester; 2003).

Due to the circulation of relaxin, laxity of the sacroiliac joint ligaments and its joint capsule occurs. This results in hypermobility of the sacroiliac joints during pregnancy and for three months post-partum (A.L. Pool-Goudzwaard, A. Vleeming, R. Stoeckart, C.J. Snijders, J.M.A. Mens; 1998).

This hormonal laxity, in conjunction with muscular weakening, may lead to post-partum low back and pelvic pain. Some patients experiencing post-partum-low back and pelvic pain, show extreme pelvic hypermobility, thereby negating the stabilisation mechanisms of the sacroiliac joints (A.L. Pool-Goudzwaard *et al*.; 1998).

Shaefer and Faye (1990) described ligamentous changes in the sacroiliac joints during pregnancy. Natural hormonal changes occur, which leads to laxity of all pelvic ligaments. These ligamentous changes are designed to make delivery of the infant less painful by allowing the pelvis to widen. However these changes have a clinically adverse effect which is the instability of the sacroiliac joint and sacrococcygeal ligaments. This instability may persist due to the ligaments requiring several months to return to their normal pre-partum length, therefore predisposing the individual to chronic sacroiliac joint irritation. This irritation often leads to sacroiliac joint fixation if not correctly managed with chiropractic adjustment.

The mother tending to the infant and loading the already compromised joints often exacerbates sacroiliac joint pain and dysfunction.

Due to the role of the sacroiliac joint during weight bearing and possibly due to its unusual anatomy, the sacroiliac joints tend to become a common source of back pain. Sacroiliac joint dysfunction seems to be more prevalent in women than men and this is possibly due to the hormone relaxin, which is secreted during menstruation, pregnancy and for a short period post-partum (G. D. Cramer, S. A. Darby; 1995).

The sacroiliac joints may cause pain in the back, groin, buttock and lower extremities similar to that pain caused by the lumbosacral region. Symptoms of the back, buttock and lower extremity may be elicited by sacroiliac joint stimulation (M. Laslett; 2003).

The signs of sacroiliac joint dysfunction often include a large degree of tenderness on pressure over the joint, and more specifically, the posterior superior iliac spines unilaterally or bilaterally. On motion palpation, movement of the joint is thus restricted (W. H. Kirkaldy-Willis, T. N. Bernard, Jr; 1999).

Mens *et al.* (2000) hypothesize that the pathogenesis of post-partum low back pain should focus on the decreased stability of the pelvic girdle.
This is based on their assumption that the pelvic girdle as a whole is stabilised by the coarse sacroiliac joint cartilage surfaces, the articular surfaces of complementary grooves and ridges, the unusual shape and the combined compressive forces of the surrounding muscles and ligaments (P. Kristiansson; 1995).

2.2. Osseous and Articular Anatomy of the Sacroiliac Joints

The pelvis is considered the inferior aspect of the trunk. The bony pelvis is formed anteriorly and laterally by the ossa coxae (comprised of the ilium ischium and the lateral aspects of the pubic bones), anteriorly by the joining of the two pubic bones at the pubic symphysis, and posteriorly by the sacrum and the coccyx (K.L. Moore; 1992).

The sacroiliac joints consist of articulations between the articular surfaces of the medial aspect of the ilium and the lateral aspect of the sacrum. The sacroiliac joint is classified as an atypical diarthrodial joint with a well-defined joint space and two opposing articular surfaces. The shape of the articular surfaces resembles an inverted ‘L’ or ‘C’ shape. The inferior limb of the articular surface faces posterio-inferiorly and the superior limb of this surface faces posterio-superiorly. Anteriorly a joint capsule lines the sacroiliac joint and posteriorly there is no articular capsule but it is covered by the strong interosseus sacroiliac joint ligament. A longitudinal groove, called the sacral groove is present on the sacral articular surface. This groove extends along its centre from the upper to the lower end. The ilial surface, which corresponds to the sacral surface, has a longitudinal ridge, known as the iliac ridge. Both the groove and the ridge interlock for increased stability, thus helping to guide the movement of the sacroiliac joint (G. D. Cramer, S. A. Darby; 1995).

It was previously thought that the sacroiliac joints were non-mobile and fused. It has since been determined that the sacroiliac joints do display movement, even if only a small amount. The mobility of these joints provides a shock absorbing quality between the lower limb and the spine. The large loads from the limbs need to be distributed and this is facilitated by the shape of the joint surfaces.

Due to the relatively flat shape of the joint surfaces, the joint is effectively designed for the transfer of compressive forces; this however makes the joint vulnerable to shear forces (A.L. Pool-Goudzwaard *et al.*; 1998).

Considering all the forces being transferred through the sacroiliac joints the joint is inherently protected. Pool-Goudzwaard *et al.* (1998) described the following three mechanisms of protection:

- The wedge-shaped sacrum is stabilised by both innominate bones
- The articular cartilage is not smooth, unlike that of other synovial joints
- Cartilage covered bone extend into the joint forming the ridges and grooves. These surfaces, although irregular are complimentary.

The area covered by the sacroiliac joint interosseus ligament, which is situated within the posterior concavity of the joint, is divided into three fossae. The fossae are the upper, middle and lower fossae.

The approximate location of the axis of rotation of the sacroiliac joint is located in the middle fossa bilaterally (G. D. Cramer, S. A. Darby; 1995).

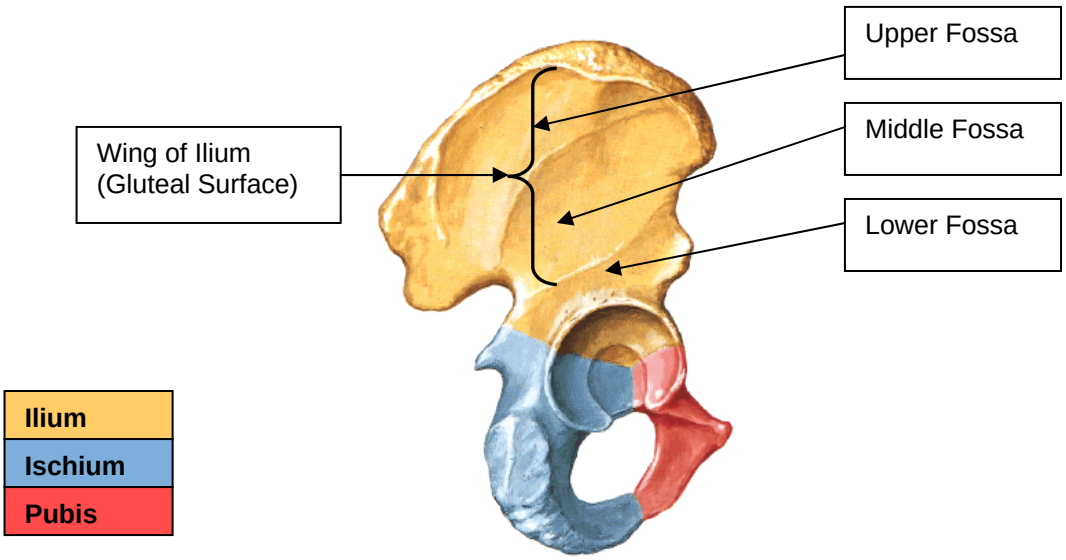


Figure 2.1 Surfaces of the Coxal Bone (Right Lateral View) (F.H. Netter; 1989).

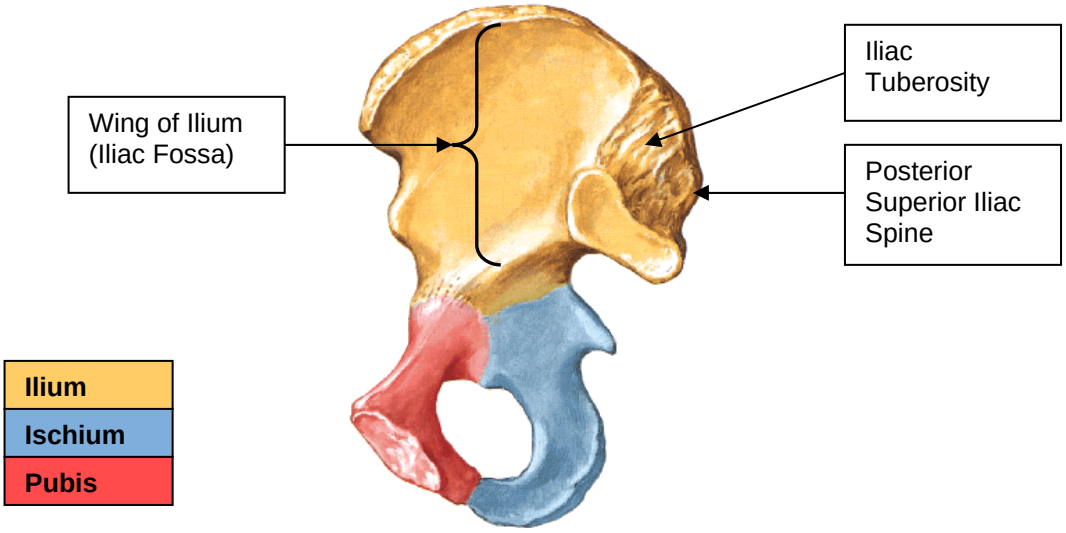


Figure 2.2 Surfaces of the Coxal Bone (Left Lateral View) (F.H. Netter; 1989).

2.3. Ligaments of the Sacroiliac Joint

The anterior, accessory, interosseous and posterior sacroiliac ligaments constitute all the ligaments attaching to and surrounding the sacroiliac joint. The interosseous and posterior sacroiliac ligaments are considered the strongest ligaments in the body (K.L. Moore; 1992).

2.3.1. Fibrous Articular Capsule

This capsule is located only on the anterior surface of the joint. It is lined with a synovial membrane and is therefore innervated by nociceptive (pain causing) and proprioceptive fibres. The posterior aspect of the joint has no articular capsule present (G. D. Cramer, S. A. Darby; 1995).

2.3.2. The Interosseous Sacroiliac Joint Ligament

This ligament connects the afore-mentioned three sacral fossae to the area in close proximity with the iliac tuberosity. It is composed of a superficial and a deeper layer.

The deeper layer is comprised of a caudal and cranial band. The posterior sacroiliac joint ligaments cover the superficial membranous layer. There is no posterior joint capsule; therefore this ligament restrains the joint posteriorly (G. D. Cramer, S. A. Darby; 1995).

2.3.3. Anterior Sacroiliac Joint Ligament

This ligament covers the anterior surface of the sacroiliac joint providing minimal support to the joint. However, the anterior interosseus ligament fuses with the articular capsule anteriorly and is thus thicker inferiorly near the region of the posterior inferior iliac spine (G. D. Cramer, S. A. Darby; 1995).

2.3.4. Posterior Sacroiliac Joint Ligament

This ligament is made up of a long and short posterior ligament. The long posterior ligament originates from the posterior superior iliac spine and the sacral tubercles of S3 and S4. It ends inferiorly by blending with the sacrotuberous ligament. The short posterior ligament originates from the sacral tubercles of S1 and S2 and attaches to the medial aspect of the posterior surface of the iliac crest and iliac tuberosity. Both ligaments cover the joint posteriorly (G. D. Cramer, S. A. Darby; 1995).

2.3.5. The Accessory Sacroiliac Joint Ligaments

Sacrotuberous ligament, sacrospinous ligament, and the iliolumbar ligament comprise the accessory sacroiliac joint ligaments, all of which provide stability to the joint (G. D. Cramer, S. A. Darby; 1995).

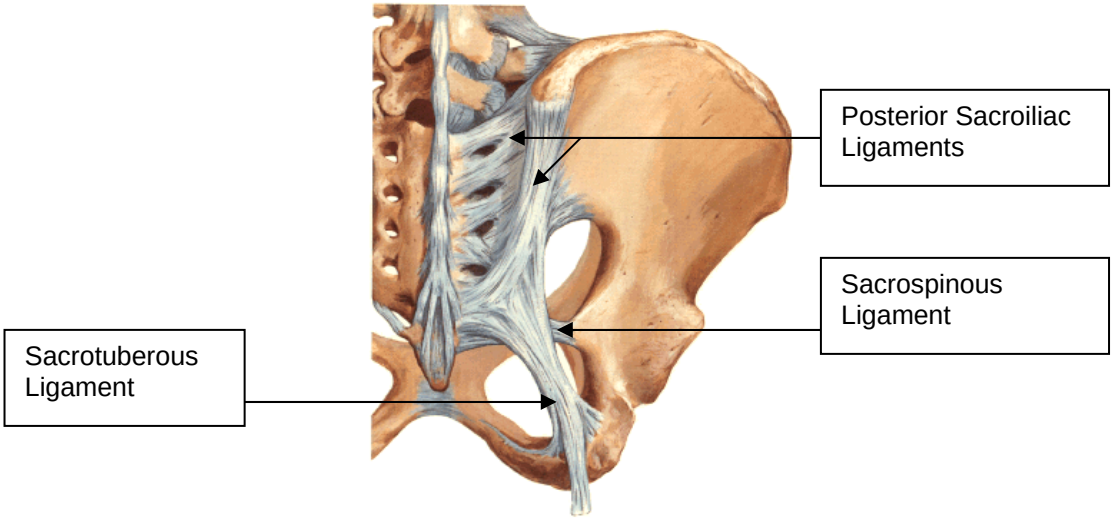


Figure 2.3 Posterior Ligaments of the Sacroiliac Joint (F.H. Netter; 1989).

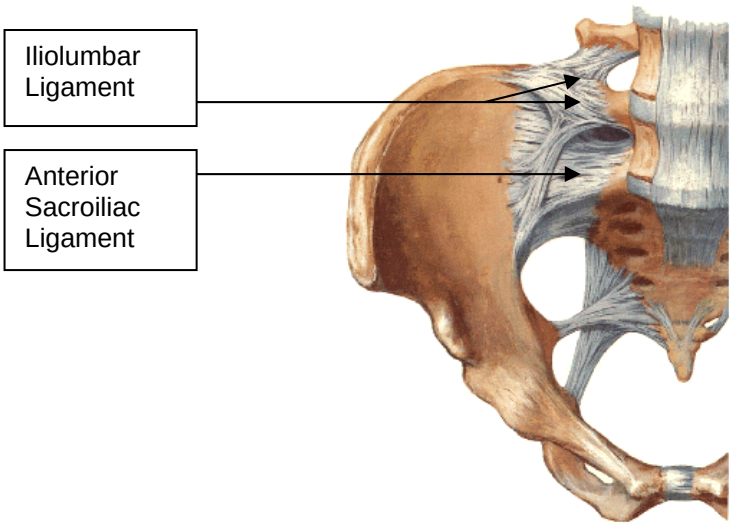


Figure 2.4 Anterior Ligaments of the Sacroiliac Joint (F.H. Netter; 1989).

2.4. Innervation of the Sacroiliac Joints

This joint is richly innervated by nociceptive and proprioceptive fibres. Due to its innervation with proprioceptors the joint relays information to the higher brain centres, which relate to joint position and movement, thus maintaining upright posture and balance (G. D. Cramer, S. A. Darby; 1995).

Variations in innervation of the joint have been noted between right and left (G. D. Cramer, S. A. Darby; 1995).

The anterior primary divisions of L2 to S2 innervate the anterior aspect of the joint, where L4 and L5 are the most frequent source of innervation.
The posterior primary divisions of S1 and S2 innervate the posterior aspect of the joint, although it has been noted that contributions can be made from L4 to S3 posterior primary divisions (G. D. Cramer, S. A. Darby; 1995).

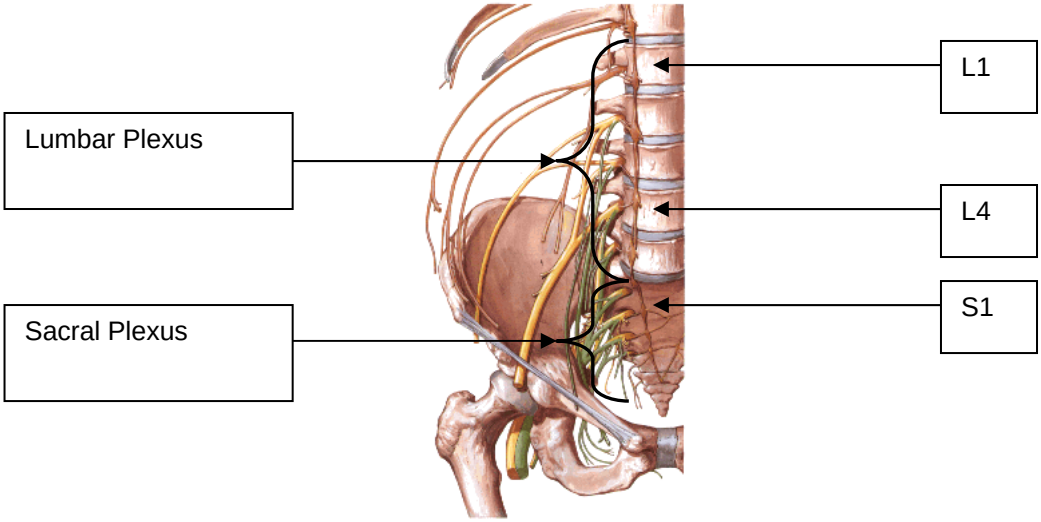


Figure 2.5 Innervation of the Sacroiliac Joint (F.H. Netter; 1989).

2.5. Anatomy of the Stabilising Muscles of the Sacroiliac Joints

The sacroiliac joint is mechanically stabilised by the following muscles:

2.5.1. Psoas Muscle

Psoas is often grouped with iliacus as the iliopsoas muscle, due the merging of the tendons at their insertion. Together they act as the primary flexors of the thigh at the hip.

They may also assist in lateral rotation and in abduction of the thigh. The iliopsoas muscle also has a secondary function in maintaining upright posture and they are continuously active during ambulation (J.G. Travell, D.G. Simons; 1998).

Anatomy of the psoas muscle is as follows:

- Origin: Lateral aspects of T12 to L5 vertebra and the corresponding intervertebral discs between them.
- Insertion: Lesser trochanter of femur.
- Innervation: Ventral rami of lumbar nerves L1, L2 and L3 (K.L. Moore; 1992).

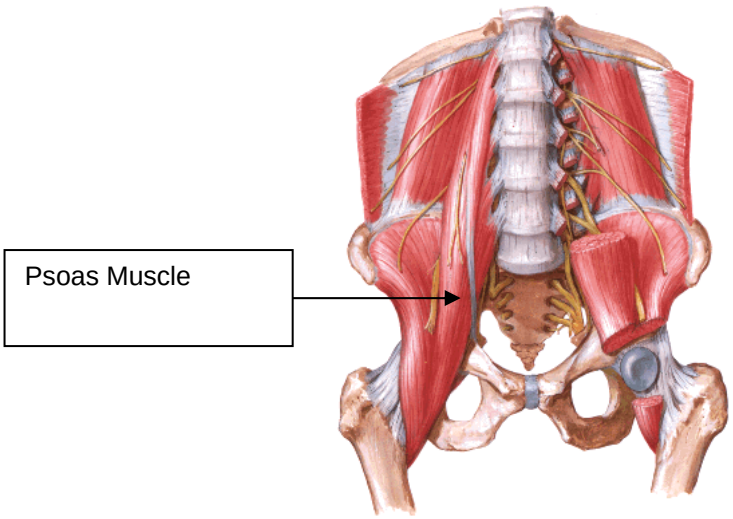


Figure 2.6 Psoas Muscle (F.H. Netter; 1989).

2.5.2. Piriformis Muscle

Piriformis muscle in the non weight bearing limb acts as an external rotator while the hip is maintained in extension, but with the hip flexed to 90˚ it acts as a hip abductor. During weight bearing activities, the piriformis muscle prevents excessive thigh medial rotation, by acting eccentrically (J.G. Travell, D.G. Simons; 1998).

Anatomy of the piriformis muscle is as follows:

- Origin: Anterior surface of sacrum and the sacrotuberous ligaments.
- Insertion: Superior border of the greater trochanter of the femur.
- Innervation: Ventral rami of S1 and S2 (K.L. Moore; 1992).

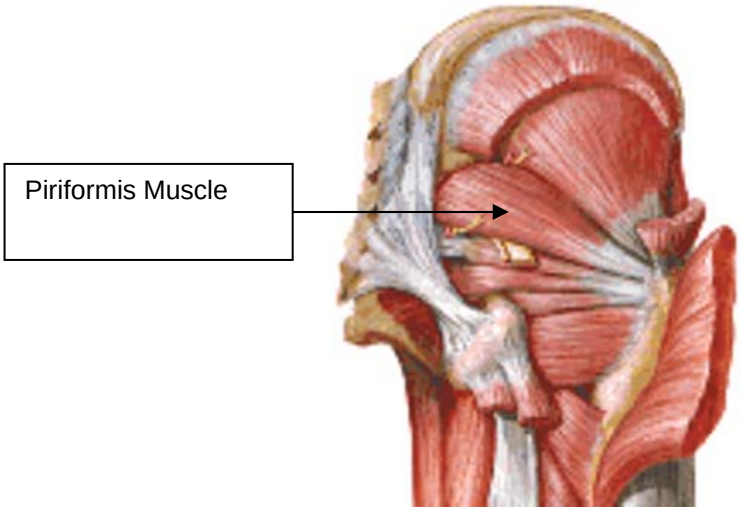


Figure 2.7 Piriformis Muscle (F.H. Netter; 1989).

2.5.3. Gluteus Medius Muscle

The main function of the gluteus medius muscle is abduction of the thigh and stabilisation of the pelvis during single limb standing (J.G. Travell, D.G. Simons; 1998).

Anatomy of the gluteus medius muscle is as follows:

- Origin: External surface of the ilium between the anterior and the posterior gluteal lines.
- Insertion: Anterior surface of the femoral greater trochanter.
- Innervation: Inferior gluteal nerve (L5, S1 and S2) (K.L. Moore; 1992).

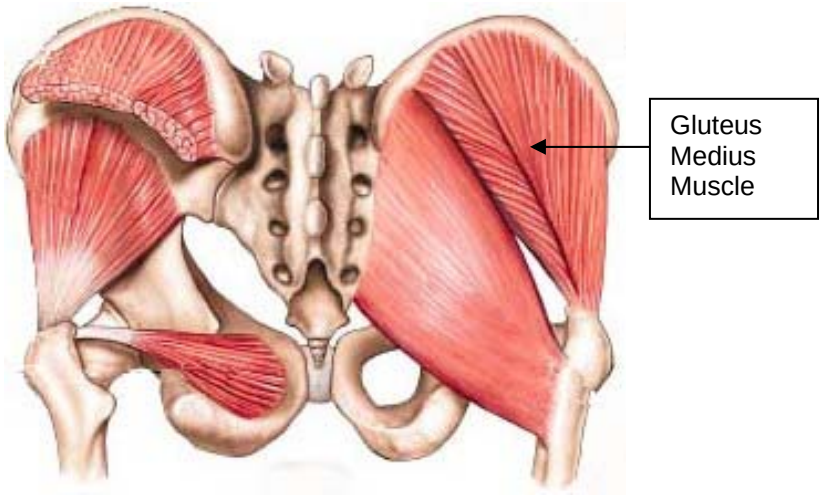


Figure 2.8 Gluteus Medius Muscle (F.H. Netter; 1989).

2.6. Rehabilitation for Low Back Pain

Extended periods of low back pain have been known to lead to altered behavioural patterns, of which pain avoidance is the most common. This altered behaviour may lead to increased dysfunction when the muscles and ligaments involved are not used to their full capacity. Therefore the functional range of motion of the joint will become limited and the actual range of motion will become decreased due to a shortening of soft tissue structures and a decrease in the involved muscle strength (M.L. Magnusson, J.B. Bishop, L. Hasselquist, K.F. Spratt, M. Szpalski, M.H. Pope M.H; 1998).

Research shows that active management of patients with low back pain is a more successful approach to reduce pain and disability in these people (H. Frost, J.A. Klaber Moffett, J.S. Moser, J.C.T. Fairbank; 1995).

Musculature plays a fundamental role in the normal functioning in the vertebral column as a whole (G.A. Jull, V. Janda; 1987).

Muscles produce and control motion by their dynamic stabilisation of the spine and possibly even function as a protective mechanism that help control large loads encountered in normal daily functioning (G.A. Jull, V. Janda; 1987).

Exercise is essential in the rehabilitation and management of patients with low back and pelvic pain (G.A. Jull, V. Janda; 1987).

Rehabilitation of patients with back pain should focus on normalisation of function and not just relief of symptoms including pain. Persistence of neuromusculoskeletal disorders, of which back pain is a major component, is difficult to manage and provide full relief from pain using passive modalities or the chiropractic adjustment alone (Journal of Canadian Chiropractic Association; 1997).

Women experiencing posterior pelvic pain that persists for longer than three months after delivery should be referred to a specialist in exercise programmes for specific muscle training of the pelvis and back. It is important to address the pelvic muscle strength in order to stabilise the pelvis, and thereafter, back muscle training can be initiated (A. Vleeming, V. Mooney, T. Dorman, C. Snijders, R. Stoeckart; 1997).

The reason exercises have been prescribed is due to the theoretical arguments against bed rest and rather for an active exercise approach to back pain. The strengthening of muscles rather than rest will prevent disuse syndromes and promote natural recovery and thus increasing psychological well being and decreasing disability that may result from back pain (G. Waddell; 1993).

Supervised exercise regimes are seen to be more successful than home exercise programs in reducing functional disability, decreasing pain and increasing the patients ability to carry out normal activities of daily living, whilst pain free (H. Frost *et al.*; 1995).

No single muscle of the sacroiliac joint crosses the joint or attaches to the joint. Although this is true, three exceptionally strong muscle groups, namely: psoas, piriformis and gluteus medius surround the sacroiliac joint (D. Chapman-Smith; 1999).

It can therefore be hypothesized that weaknesses in any of these muscle groups coupled with ligament laxity will predispose a person to recurrent back pain. This is often true for women suffering with post-partum back pain. Through this deduction one can assume that then strengthening the muscle groups around the sacroiliac joint and treating sacroiliac joint dysfunction will reduce post-partum back pain.

Poor strength in the related musculature is a factor in the development of low back pain. Low back strength can be increased with muscular strength and resistance training techniques, thereby decreasing pain (M.L. Pollock, S.H. Leggett, J.E. Graves, A. Jones, M. Fulton, J. Cirulli; 1989).

It is important to realize that vigorous exercise may cause an increase in pain, as such exercises rely on a stable pelvis, and therefore the use of dynamic slow strengthening of these muscles is preferred (A. Vleeming *et al.*; 1997).

2.6.1. Rehabilitation Exercises

The following exercises will be included in the treatment protocol for these patients due to the pelvic and back muscles needing to be strengthened, in order to regain full pain free function of the pelvic joints in post-partum women (H. Spring, U. Illi, H. Kunz, K. Rothlin, W. Schneider, T. Tritschler; 1991).

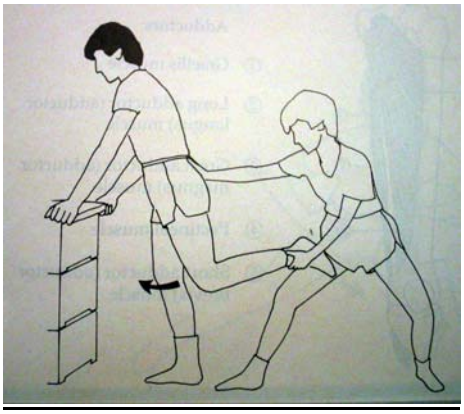


Figure 2.9 Dynamic Slow Strengthening of the Psoas Muscle (H. Spring *et al.*; 1991).

The doctor stands directly behind the patient stabilising the patient's sacrum with one hand while the other hand grasps the patient's ankle. The doctor resists while the patient draws their knee forward. This exercise is held for ten seconds (H. Spring *et al.*; 1991).

Figure 2.10 Dynamic Slow Strengthening of the Piriformis Muscle (H. Spring *et al.*; 1991).

The doctor stands behind the lateral recumbent patient stabilising the patient's hip with one hand while the other hand applies a downward pressure on the patient's already raised leg. The patient's foot remains in the neutral position. The doctor resists while the patient pushes their leg upward. This exercise is held for ten seconds (H. Spring *et al.*; 1991).

Raised foot maximally externally rotated.

Figure 2.11 Dynamic Slow Strengthening of the Piriformis Muscle (H. Spring *et al.*; 1991).

The doctor stands behind the lateral recumbent patient stabilising the patient's hip with one hand while the other hand applies a downward pressure on the patient's already raised leg; with the foot of the raised leg maximally externally rotated. The doctor resists while the patient pushes their leg upward. This exercise is held for ten seconds (H. Spring *et al.*; 1991).

2.7. The Chiropractic Adjustment

For the purposes of this study the terms Chiropractic Manipulative Therapy and Chiropractic Adjustment are synonymous.

Manipulation can be defined as a manual procedure which is administered by chiropractors, that involves a dynamic thrust that is directed at a joint to force the joint past the physiological range of motion without exceeding the anatomical limit. This is a highly skilled procedure that involves a controlled force, direction, amplitude and velocity on a specific joint (Journal Canadian Chiropractic Association; 1997).

The chiropractic adjustment or manipulation is mainly a mechanical force applied to the joint thereby causing the force to interact with extremely dynamic spinal tissue (S. Haldeman; 2000).

2.7.1. The Phases of an Adjustment

Sandoz (1976) divided the phases of movement into the following categories:

a) Active range of motion: This is the range of motion that a joint can travel through when actively assisted by the muscles and ligaments that cross the joint.
b) Passive range of motion: This is the range of motion that a joint can travel through when assisted by an outside force. Passive range of motion is greater than the active range of motion for the same joint. Both active and passive range of motion, together comprise the physiological range of motion for a specific joint.
c) At the end range of passive movement, resistance is encountered. This is named the elastic barrier of resistance. In mobilisation, the joint involved is moved within the physiological range and never passed this elastic barrier.
d) Beyond the elastic barrier of resistance the paraphysiological space is encountered. For any joint to move into this space it needs to traverse the elastic barrier. At this point of crossing, a “crack” is heard.

e) This sound is due to gases being suddenly released from the synovial fluid of the joint. This release of gas is known by physicists; as the cavitation.

f) At the extreme limit of the paraphysiological space a final barrier is encountered. This barrier is known as the limit of anatomical integrity. Any movement beyond this limit would result in ligamentous and capsular damage, ranging from a slight sprain to complete rupture.

It is important that the adjustment forces the involved joint to cross the elastic barrier of resistance, without exceeding the limit of anatomical integrity (R. Sandoz; 1976).

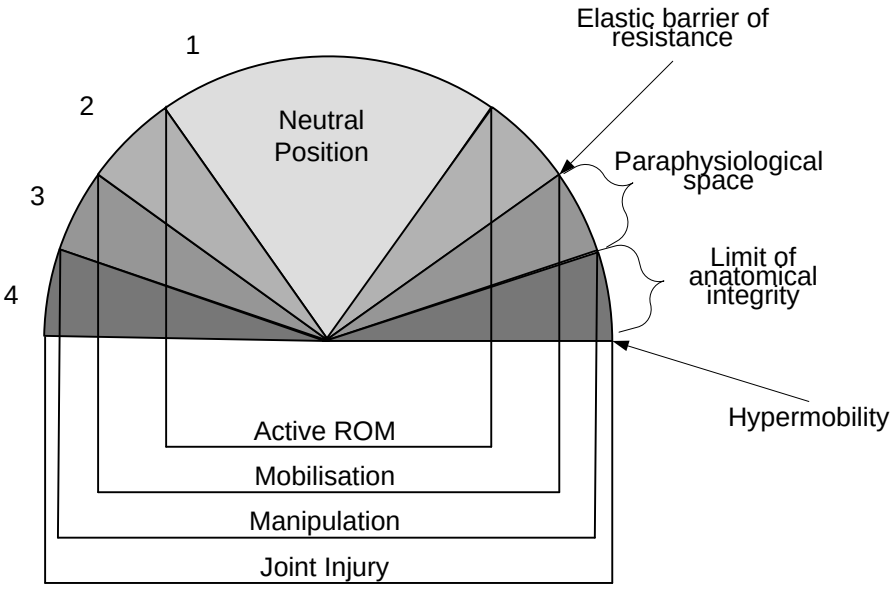


Figure 2.12 The Phases of an Adjustment (R. Sandoz; 1976).

2.8. The Effects of the Chiropractic Adjustment

Haldeman (2000) explained that it is nearly impossible to determine the exact mechanism by which the adjustment can relieve pain.

There is a definite decrease in patients' perceived pain after manipulation, the mechanism that results in this decrease, however, is largely unknown (J.D. Dishman, R. Bulbulian; 2000).

There have been a few hypotheses, of the effects of the chiropractic manipulation postulated, some of which will be discussed in the following paragraphs.

If manipulation of the sacroiliac joint is to be performed, it must only be administered three months post-partum because it is only after this time the effects of the hormone relaxin have worn off. It has been considered that neither manipulation alone nor rehabilitation alone is as beneficial as the two combined (A. Vleeming *et al.*; 1997).

2.9. Neurological Effects of Manipulation

The most widely accepted theory on the effects of the chiropractic manipulation relies on the premise of nerve compression. This theory postulates that the main effect of the chiropractic manipulation is to correct a subluxation (S. Haldeman; 2000).

Haldeman (2000) defines the subluxation as an abnormal biomechanical relationship between vertebrae that may cause compression of nerve roots. This in turn results in aberrant functioning of the normal nerve root, which causes pain.

The American Chiropractic Association (ACA) classifies the subluxation as the "immobilisation of a vertebra in a position of movement when the spine is at rest or in a position of rest when the spine is in movement." (M.L. Gatterman; 1990)

The medical fraternity, however, defines the subluxation as an “incomplete luxation or dislocation.” Therefore there is often confusion between the two disciplines of medicine and chiropractic over this term. For the purposes of this study the term subluxation will denote the ACA classification (J.H. Dirckx; 1997).

2.9.1. Sensory Neural Effects

Pickar and Wheeler (2001) postulate that impulse based neural activity is affected by spinal and sacroiliac joint manipulation thereby altering the flow of sensory information into the spinal cord.

The vertebral column’s receptive nerve endings are stimulated by the introduction of mechanical forces onto the paraspinal tissues, including muscles, ligaments, joints and tendons (J. G. Pickar, J. D. Wheeler; 2001).

2.9.2. Nociceptive Effects

Injured tissues release chemical nociceptors that irritate the sensory end organs, releasing impulses to the dorsal root ganglia via unmyelinated C and A alpha fibres causing the perception of pain. A specific chiropractic adjustment to correct aberrant joint function would therefore relieve pain and remove noxious stimulus (D. Chapman-Smith; 1989).

2.9.3. Reflex Theories

Due to the rich neural input form the spinal tissues, which include the facet joints, ligaments and muscles, altered functioning of any of these structures would stimulate receptors found in the spinal cord or higher neural centres (S. Haldeman; 2000).

These receptors are sensitive to temperature, inflammation and mechanical changes. Muscles, ligaments and facet joints each have their own specialized neural receptors with varying sensitivities and characteristics (S. Haldeman; 2000).

Stimulation causes a response in the sympathetic and parasympathetic nervous systems, resulting in pain. The adjustment causes activation of these receptors resulting in stimulation of reflex pathways (S. Haldeman; 2000).

The adjustment is believed to stimulate the higher neural centres thereby reducing the perception of pain by activating these central reflex pathways. The period of pain reduction from these reflexes has yet to be established (S. Haldeman; 2000).

2.9.4. Pain Relieving Theories

There has been evidence presented supporting the chiropractic adjustment as a cause of hypoalgesia. This is theorized to be due to central facilitation from stimulation of spinal structures which result in changes to cutaneous and muscular pain thresholds. The release of endorphins after the adjustment has also been proposed. Since there is insufficient information on a singular cause of spinal pain, the exact mechanism by which the adjustment reduces this pain still needs to be established (S. Haldeman; 2000).

2.10. Determining Sacroiliac Joint Dysfunction

Motion palpation of the sacroiliac joints is a common means of determining sacroiliac dysfunction in patients.

2.10.1. Gillet's Method of Motion Palpation of the Sacroiliac Joints

Gillet's method of motion palpation of the sacroiliac joints requires palpation of the relationship between the posterior superior iliac spine (PSIS) and the second sacral segment. With hip flexion in a normal patient, the PSIS move inferiorly. With a fixated sacroiliac joint the PSIS remains level with hip flexion (S. Haldeman; 1992).

A fixation is defined as a state whereby a vertebra or pelvic bone has become temporarily immobilised in a position that is normally occupied during any phase of physiological phase of spinal movement (M.L. Gatterman; 1990).

Chapter 3: Methodology

3.1. Aim of this Study

This study aimed to determine if manipulation of the sacroiliac joints alone or in conjunction with stability exercises, designed at stabilising the pelvis, caused a decrease in pain in individuals with post-partum back pain. This research was therefore exploratory in nature.

Scientifically, the significance of this research was the possible role sacroiliac joint manipulation and pelvic strengthening exercises played in the treatment of post-partum back pain. If the research suggested that treating the sacroiliac joints with manipulation and specific pelvic strengthening exercises lead to a decrease in back pain in post-partum women, it would encourage practitioners to educate pregnant women to seek this form of treatment post delivery.

3.2. Hypothesis

It was hypothesised that Chiropractic Manipulative Therapy (CMT) and slow dynamic strengthening exercises of the pelvis and the combination of CMT and slow dynamic strengthening exercises of the pelvis would produce beneficial results for all the patients involved. It was assumed that the combination of CMT and slow dynamic strengthening exercises would be the most effective as a treatment protocol for woman suffering from post-partum low back pain.

3.3. Patient Selection

This study consisted of thirty patients. The patients were recruited by advertisements and pamphlets in the local medical facilities, posters were placed at the TWR Health Clinic, nursery schools and Morningside Dispensary (Appendix F) and (Appendix G).

Patients eligible to enter the study were between eighteen and fifty years of age, and had delivered a baby at least three months before treatment commenced. The selected patients were required to complete a consent form (Appendix A). The patients were divided up into three groups of ten patients each.

Group 1 was treated using diversified CMT of the sacroiliac joints.
Group 2 was treated with dynamic slow strengthening exercises of the stabilising muscles around the pelvis.
Group 3 was treated using a combination of CMT to their sacroiliac joints and dynamic slow exercise to the pelvic stabilising muscle groups.

Dynamic slow strengthening exercises involved movement. This method of strengthening is also known as isokinetic strength training. Dynamic slow strength training increases muscle cross-section and muscle endurance (H. Spring *et al.*; 1991).

A full medical history (Appendix C), pertinent physical examination (Appendix D), a lumbar spine regional examination (Appendix F) and motion palpation of the sacroiliac joint were performed on all participants to determine dysfunction.

3.4. Patient Screening

Patients eligible for this study were healthy female patients between the ages of eighteen and fifty. The patients presented with low back pain on initial consultation. The patients needed to be at least three months post-partum at the time of the consultation.

3.4.1. Patient Exclusion Criteria:

a) Any trauma leading to the back pain that has not been radiographically investigated.
b) Neurological complications such as disc lesions and nerve root damage.
c) Any visceral pathology that may be causing the back pain.
d) Any contraindications for CMT.

- ❖ General Contraindications to CMT
  - ➢ Aortic aneurysm
  - ➢ Tumour e.g. Primary and Metastatic
  - ➢ Bone infection e.g. Tuberculosis (Pott's Disease) and Osteomyelitis
  - ➢ Traumatic injury e.g. Articular trauma, Spinal Haematosis and Patients on anticoagulant therapy
  - ➢ Arthritides
  - ➢ Congenital Malformation e.g. Hypermobility and Excessive Spondylolisthesis
  - ➢ Neurological Complications e.g. Disc Lesions, Myelopathy, Nerve Root Damage and Cauda Equina Syndrome
  - ➢ Arthritides in Inflammatory Stages e.g. Ankylosing Spondylosis, Rheumatoid Arthritis, Reiter's Syndrome and Osteoarthritis

3.5. Evaluation and Treatment

The patients included in this research study were required to complete a patient details form (Appendix B) and disclose a full medical history (Appendix C). All groups underwent a lumbar spine and pelvis regional examination (Appendix F).

Each of the three groups consisted of ten patients. Each patient was treated a total of six times in a period of three weeks, with two treatments per week.

The tables that follow show in detail the order of procedures for each participant at each of the treatments.

Table 3.1 Group One – Treatment Protocol

Visit Number	***Procedure***
One	➢ Consent Form ➢ Full Medical History ➢ Pertinent Physical Examination ➢ Lumbar Spine and Pelvis Regional Examination ➢ Oswestry Low Back Pain and Disability Questionnaire ➢ Numerical Pain Rating Scale ➢ Modified Schober's Test ➢ Gillet's Sacroiliac Motion Palpation ➢ Diversified CMT
Two	➢ Gillet's Sacroiliac Motion Palpation ➢ Diversified CMT
Three	➢ Oswestry Low Back Pain and Disability Questionnaire ➢ Numerical Pain Rating Scale ➢ Modified Schober's Test ➢ Gillet's Sacroiliac Motion Palpation ➢ Diversified CMT
Four	➢ Gillet's Sacroiliac Motion Palpation ➢ Diversified CMT
Five	➢ Gillet's Sacroiliac Motion Palpation ➢ Diversified CMT

Visit Number	*Procedure*
Six	➢ Oswestry Low Back Pain and Disability Questionnaire ➢ Numerical Pain Rating Scale ➢ Modified Schober's Test ➢ Gillet's Sacroiliac Motion Palpation ➢ Diversified CMT

Table 3.2 Group Two – Treatment Protocol

Visit Number	*Procedure*
One	➢ Consent Form ➢ Full Medical History ➢ Pertinent Physical Examination ➢ Lumbar Spine and Pelvis Regional Examination ➢ Oswestry Low Back Pain and Disability Questionnaire ➢ Numerical Pain Rating Scale ➢ Modified Schober's Test ➢ Gillet's Sacroiliac Motion Palpation ➢ Slow Dynamic Strengthening Exercises of Gluteus Medius, Piriformis and Psoas Muscles
Two	➢ Gillet's Sacroiliac Motion Palpation ➢ Slow Dynamic Strengthening Exercises of Gluteus Medius, Piriformis and Psoas Muscles

Visit Number	*Procedure*
Three	➢ Oswestry Low Back Pain and Disability Questionnaire ➢ Numerical Pain Rating Scale ➢ Modified Schober's Test ➢ Gillet's Sacroiliac Motion Palpation ➢ Slow Dynamic Strengthening Exercises of Gluteus Medius, Piriformis and Psoas Muscles
Four	➢ Gillet's Sacroiliac Motion Palpation ➢ Slow Dynamic Strengthening Exercises of Gluteus Medius, Piriformis and Psoas Muscles
Five	➢ Gillet's Sacroiliac Motion Palpation ➢ Slow Dynamic Strengthening Exercises of Gluteus Medius, Piriformis and Psoas Muscles
Six	➢ Oswestry Low Back Pain and Disability Questionnaire ➢ Numerical Pain Rating Scale ➢ Modified Schober's Test ➢ Gillet's Sacroiliac Motion Palpation ➢ Slow Dynamic Strengthening Exercises of Gluteus Medius, Piriformis and Psoas Muscles

Table 3.3 Group Three – Treatment Protocol

Visit Number	***Procedure***
One	➢ Consent Form ➢ Full Medical History ➢ Pertinent Physical Examination ➢ Lumbar Spine and Pelvis Regional Examination ➢ Oswestry Low Back Pain and Disability Questionnaire ➢ Numerical Pain Rating Scale ➢ Modified Schober's Test ➢ Gillet's Sacroiliac Motion Palpation ➢ Diversified CMT ➢ Slow Dynamic Strengthening Exercises of Gluteus Medius, Piriformis and Psoas Muscles
Two	➢ Gillet's Sacroiliac Motion Palpation ➢ Diversified CMT ➢ Slow Dynamic Strengthening Exercises of Gluteus Medius, Piriformis and Psoas Muscles
Three	➢ Oswestry Low Back Pain and Disability Questionnaire ➢ Numerical Pain Rating Scale ➢ Modified Schober's Test ➢ Gillet's Sacroiliac Motion Palpation ➢ Diversified CMT ➢ Slow Dynamic Strengthening Exercises of Gluteus Medius, Piriformis and Psoas Muscles

Visit Number	*Procedure*
Four	➢ Gillet's Sacroiliac Motion Palpation ➢ Diversified CMT ➢ Slow Dynamic Strengthening Exercises of Gluteus Medius, Piriformis and Psoas Muscles
Five	➢ Gillet's Sacroiliac Motion Palpation ➢ Diversified CMT ➢ Slow Dynamic Strengthening Exercises of Gluteus Medius, Piriformis and Psoas Muscles
Six	➢ Oswestry Low Back Pain and Disability Questionnaire ➢ Numerical Pain Rating Scale ➢ Modified Schober's Test ➢ Gillet's Sacroiliac Motion Palpation ➢ Diversified CMT ➢ Slow Dynamic Strengthening Exercises of Gluteus Medius, Piriformis and Psoas Muscles

The patients were required to complete subjective pain questionnaires on the first, third and sixth treatments. The Oswestry Low Back Pain and Disability Questionnaire (Appendix B) measured the patient's pain and disability in daily activities. The Numerical Pain Rating Scale (Appendix C) is an eleven point scale which allowed the patient to rate the intensity of their pain.

3.6. Data Collection and Interpretation

3.6.1. Objective Data

Modified Schober's test was used to record objective findings.
This objective reading was collected on the first, third and sixth treatments, before treatment was administered. Modified Schober's test measures the amount of flexion occurring in the lumbar spine and pelvis from an erect position to a fully forward flexed position. This test was preformed by doing the following:

1. Patient was asked to stand with their feet shoulder width apart, with their knees extended, arms kept relaxed at their sides and their body weight centred.
2. Examiner marked the level of S2 in line with the level of the Posterior Superior Iliac Spines (PSIS) bilaterally.
3. Examiner marked point A 0.5cm below S2 and point B 10cm above the level of S2.
4. The distance between point A and point B was measured as 10.5cm.
5. Examiner asked patient to flex at the lumbar spine as far forward as their pain would allow, keeping their knees extended, arms relaxed and their head in the neutral position.
6. Once the patient was in maximal flexion the examiner measured the distance between point A and point B.
7. The patient was then allowed to return to a normal standing position.
8. The final measurement was subtracted from the initial length of 10,5cm.
9. This final measurement indicated the amount of flexion occurring in the lumbar spine and pelvis.
10. The distance should, in optimally functioning joints, have increased at least 5cm to 8cm. (R.C. Evans; 1994)

11. This reading was repeated three times to ensure reliability and accuracy of the objective measurements.

3.6.2. Subjective Measurements

The subjective questionnaires were completed by the patients before any form of assessment or treatment was administered.

3.6.2.1. Oswestry Low Back Pain and Disability Questionnaire

The Oswestry Low Back Pain and Disability Questionnaire is a ten sectioned questionnaire, with each section having six options. Each option is given a point rating of between zero and six. The most severe pain and disability option rates at six points and the least severe at zero points with the remaining options rating from one to five points in severity. The patient was instructed to mark only the most relevant option per section with regard to their pain, at the time of completing the questionnaire. The points allocated per section were then calculated to get a final score out of a possible fifty points. The percentage pain and disability was then calculated as follows:

$$\frac{\text{Total Score}}{\text{Total possible Score}} \times 100 = \text{Percentage Pain and Disability}$$

Example: $\frac{22}{50} \times 100 = 44\%$ Pain and Disability

If the patient marked more than one option per section, the worst of the two options was selected. If one section was not marked the calculation was modified to calculate only nine out of the ten sections as follows:

Total Score ___ x 100 = Percentage Pain and Disability
Total possible Score

Example: 22 x 100 = 49% Pain and Disability
45

3.6.2.2. Numerical Pain Rating Scale

The Numerical Pain Rating Scale (NPRS) is an eleven point scale modified from the Visual Analogue Scale (VAS). This eleven point NPRS is a horizontal line of eleven blocks labelled 0 to 10 (Appendix G). Under the block marked “0” is stated “no pain”, and under the block marked “10” is stated “worst pain ever experienced”. The patient was instructed to mark only one number on the scale, the most relevant to their pain at the time of consultation. This NPRS was completed on the first, third and sixth treatments. The NPRS expressed as a percentage is calculated as follows:

Numerical value marked by patient x 100 = Pain Scale Rating as a %
10

Example: 5 x 100 = 50%
10

The NPRS is the pain scale recommended to be the most reliable of all the pain scales and is the preferred scale for the use in research trials involving pain rating, due to its ease of use and increased responsiveness and sensitivity to fluctuating pain intensities (J.E. Bolton, R.C. Wilkinson; 1998).

3.7. Statistical Analysis

3.7.1. Processing of Data

The purpose of the statistical analysis was to determine if significant differences were noted over the treatment period, particularly the effectiveness of the treatments applied at the sixth/final treatment compared to the first/initial treatment. The statistical analysis was conducted on a 95% confidence level.

3.7.1.1. Demographic Data

Demographic data was tabulated separately under the headings age, height, weight and body mass index. Each heading has a separate mean and P-value. The tables were divided into the three treatment groups, and their combined totals.

3.7.1.2. Subjective Data

The data collected from the Oswestry Pain and Disability Questionnaire and the Numerical Pain Rating Scale was reviewed to ensure that the questionnaire and the scale had been correctly completed. The questionnaires and the scales were completed, prior to the commencement of treatment, on the first, third and sixth visits. Following this, the gathered results were converted to a percentage and the processed data was then statistically analyzed.

3.7.1.3. Objective Data

Lumbar spine range of motion was measured using Modified Schober's test, this orthopaedic test measures forward flexion from the second sacral segment to the twelfth thoracic vertebra. The processed data was statically analysed.

3.7.2. Statistical Analysis of the Data

All the above-mentioned data was statistically analysed using the Statistical Programme for Social Studies version 12 Incorporated. The parametric one-way Anova test, the Scheffe Multiple Comparisons test and the Paired-t test was used for the intra-group and inter-group analysis.

The null hypothesis states that there is a statistically significant difference between the means of the groups compared when $P < 0.05$; thus if $P > 0.05$, then no statistically significant difference exists between the groups compared.

3.7.2.1. Statistical Analysis of the Data

The data collected from the Oswestry Pain and Disability Questionnaire and the Numerical Pain Rating Scale were statistically analysed using the one-way Anova test and the Paired-t test on each group separately. The comparisons were prepared as follows:

a) Visit one compared with visit three
b) Visit one compared with visit six
c) Visit three compared with visit six

The results were statistically compared with each other in order to ascertain whether any statistically significant difference between visits existed.

The data collected from the Oswestry Pain and Disability Questionnaire and the Numerical Pain Rating Scale were statistically analysed using the one-way Anova test and the Paired-t test to form a comparison between the groups.

The comparisons were prepared as follows:

a) Group one, group two and group three at visit one
b) Group one, group two and group three at visit three
c) Group one, group two and group three at visit six

The results were statistically compared with each other in order to ascertain whether any statistically significant difference between visits existed.

3.7.2.2. Analysis of Objective Data

The data collected from the Modified Schober's test analysis were statistically analysed using the one-way Anova test, the Scheffe Multiple Comparisons test and the Paired-t test on each group separately. The comparisons were prepared as follows:

a) Visit one compared with visit three
b) Visit one compared with visit six
c) Visit three compared with visit six

The results were statistically compared with each other in order to ascertain whether any statistically significant difference between visits existed.

The data collected from the Modified Schober's test analysis were statistically analysed using the one-way Anova test, the Paired-t test and the Scheffe Multiple Comparisons test to form a comparison between the groups. The comparisons were prepared as follows:

a) Group one, group two and group three at visit one
b) Group one, group two and group three at visit three
c) Group one, group two and group three at visit six

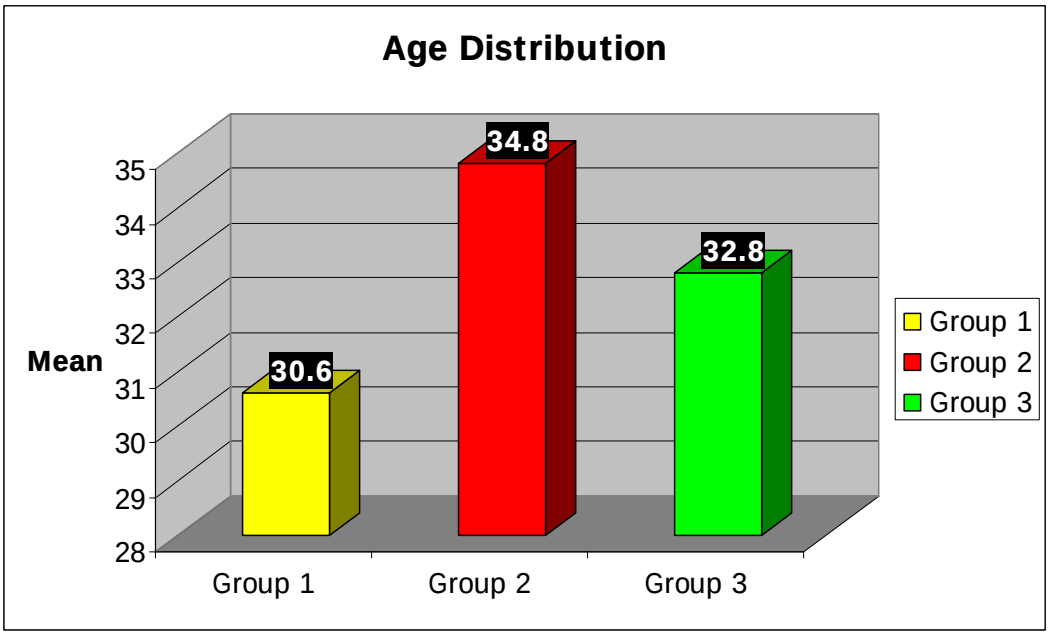
The results were statistically compared with each other in order to ascertain whether any statistically significant difference between visits existed.

For any further information pertaining to the statistical analysis please consult Appendix J through Appendix N.

Chapter 4: Results

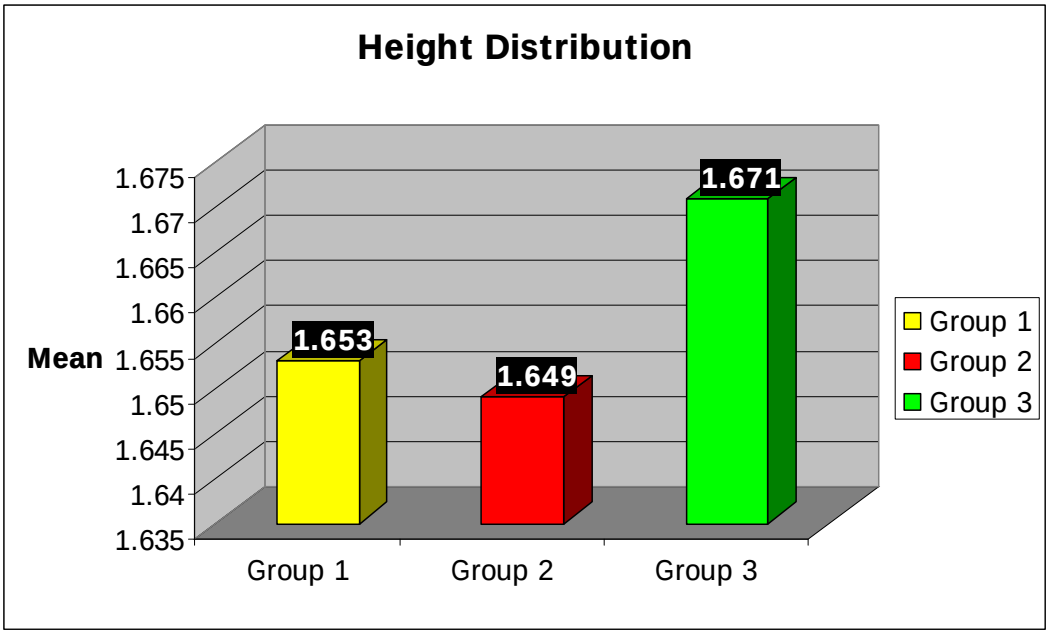
4.1. Demographic Data

Graph 4.1 Age Distribution



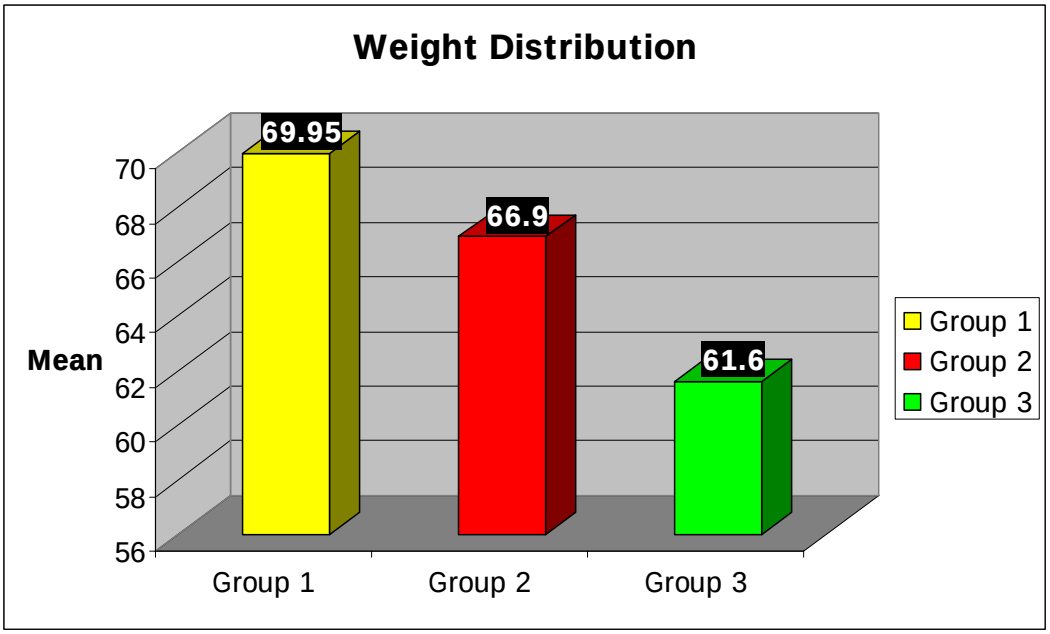
Upon inter-group analysis, Graph 4.1 illustrates that there was no statistically significant difference of the mean ages between group 1; group 2 and group 3 ($P>0.05$).

Graph 4.2 Height Distribution



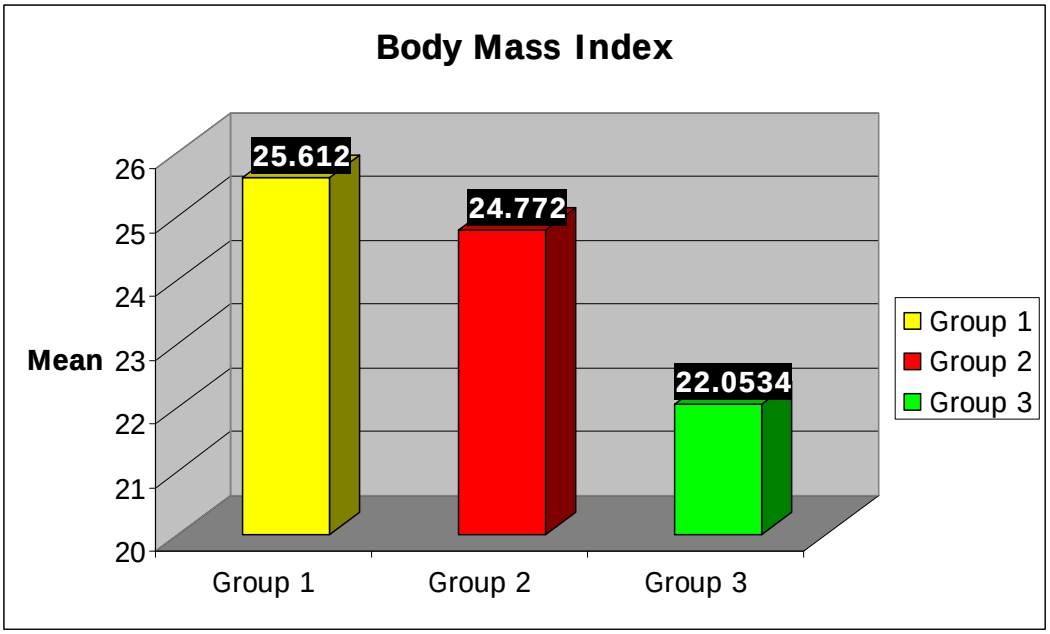
What can be seen from Graph 4.2, upon intra-group analysis, is that there was no statistically significant difference of the mean heights between group 1; group 2 and group 3 ($P>0.05$).

Graph 4.3 Weight Distribution



What can be seen from Graph 4.3, upon intra-group analysis, is that there was no statistically significant difference of the mean weights between group 1; group 2 and group 3 ($P>0.05$).

Graph 4.4 Body Mass Index

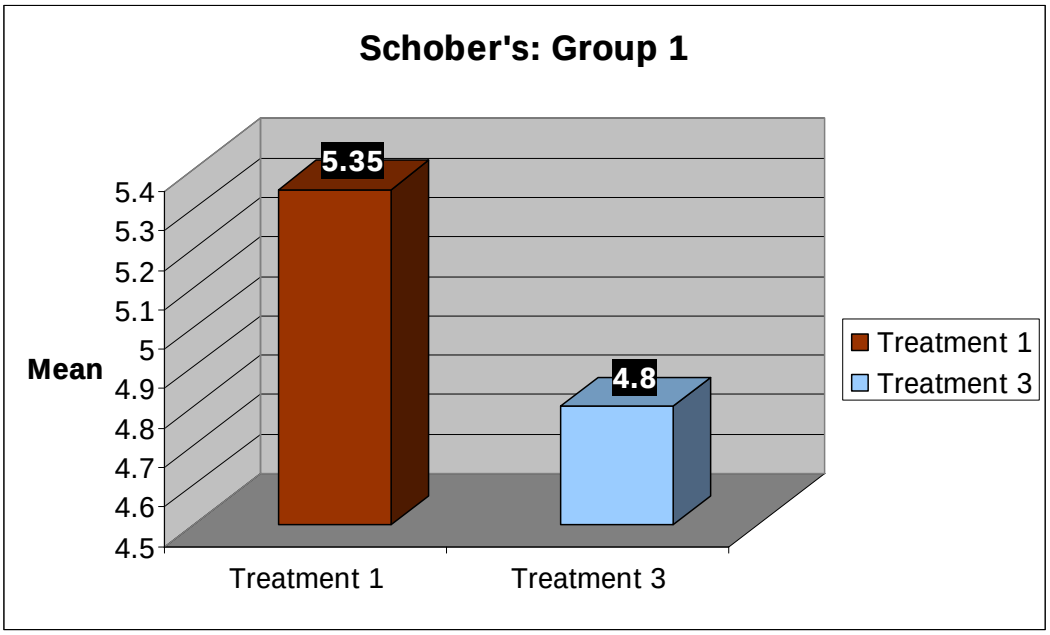


What can be seen from Graph 4.4, upon intra-group analysis, is that there was no statistically significant difference of the mean body mass index between group 1; group 2 and group 3 ($P>0.05$).

4.2. Objective Data

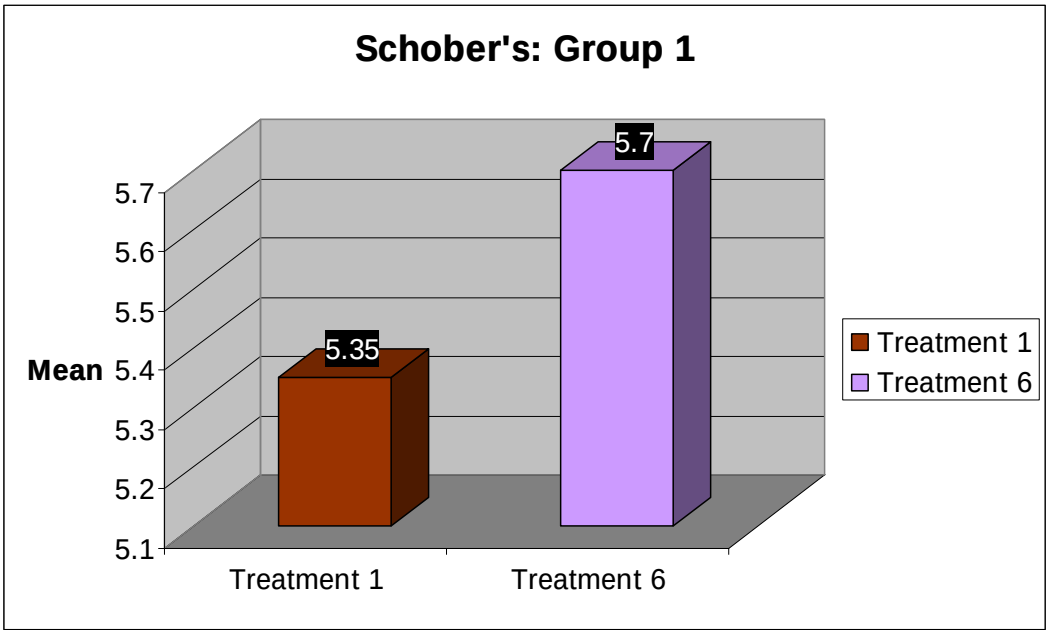
4.2.1. Statistical Analysis of Modified Schober's Test (Intra-group)

Graph 4.5 Modified Schober's Test Group 1: Treatment 1 versus Treatment 3



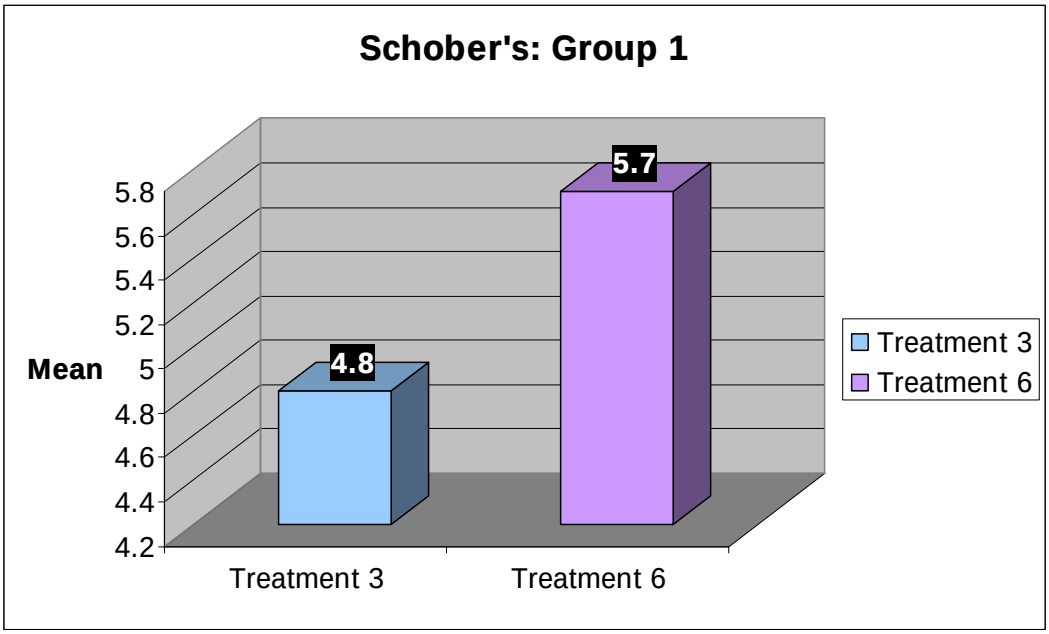
What can be seen from Graph 4.5, upon intra-group analysis, is that there was no statistically significant difference of the mean Modified Schober's Test of group 1 for treatment 1 versus treatment 3 ($P>0.05$).

Graph 4.6 Modified Schober's Test Group 1: Treatment 1 versus Treatment 6



What can be seen from Graph 4.6, upon intra-group analysis, is that there was no statistically significant difference of the mean Modified Schober's Test of group 1 for treatment 1 versus treatment 6 ($P>0.05$).

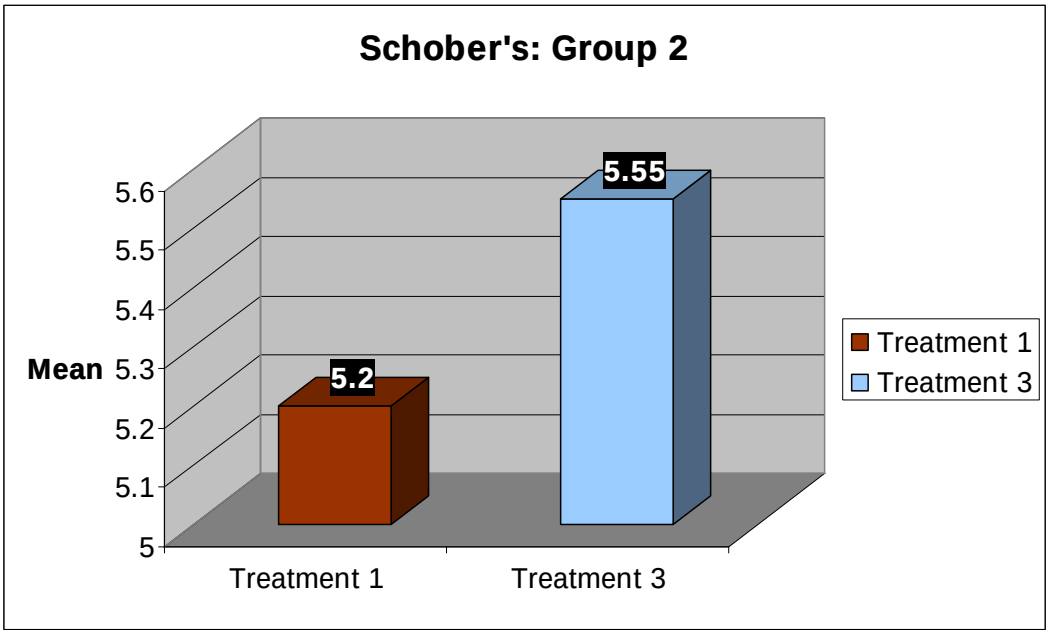
Graph 4.7 Modified Schober's Test Group 1: Treatment 3 versus Treatment 6



What can be seen from Graph 4.7, upon intra-group analysis, is that there was no statistically significant difference of the mean Modified Schober's Test of group 1 for treatment 3 versus treatment 6 ($P>0.05$).

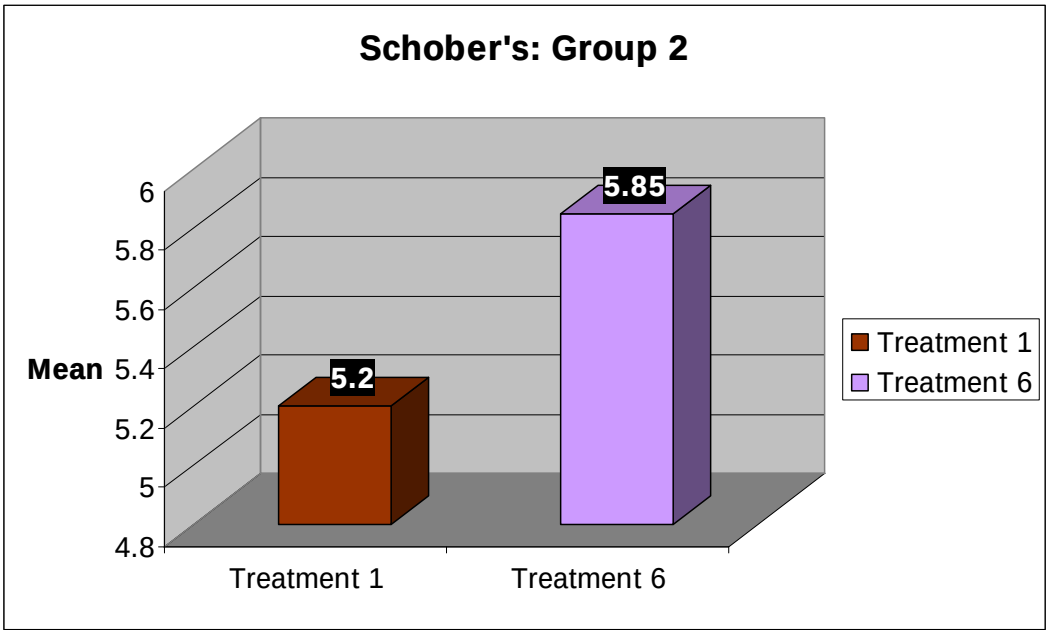
In summary of Group 1's modified Schober's test as seen in Graphs 4.5, 4.6 and 4.7 no statistically significant values were established.

Graph 4.8 Modified Schober's Test Group 2: Treatment 1 versus Treatment 3



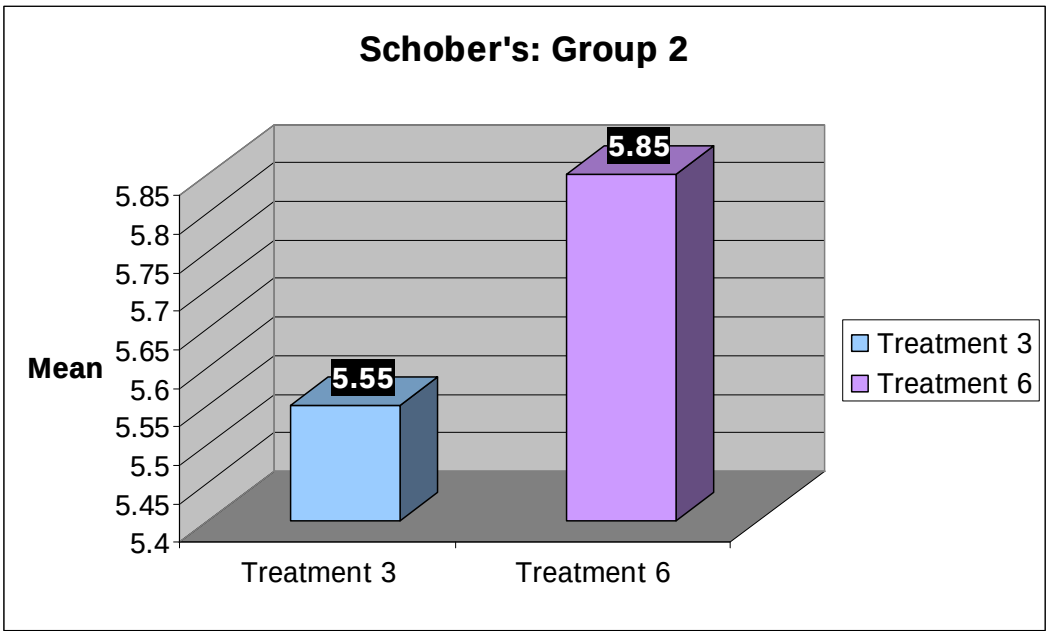
What can be seen from Graph 4.8, upon intra-group analysis, is that there was a statistically significant difference of the mean Modified Schober's Test of group 2 for treatment 1 versus treatment 3 ($P<0.05$).

Graph 4.9 Modified Schober's Test Group 2: Treatment 1 versus Treatment 6



What can be seen from Graph 4.9, upon intra-group analysis, is that there was a statistically significant difference of the mean Modified Schober's Test of group 2 for treatment 1 versus treatment 6 ($P<0.05$).

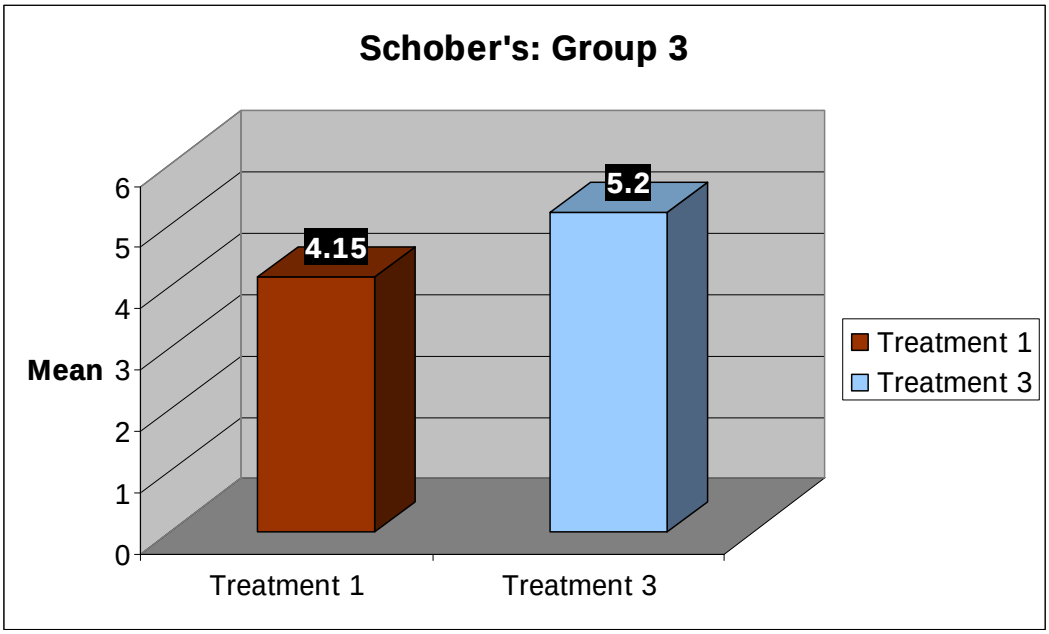
Graph 4.10 Modified Schober's Test Group 2: Treatment 3 versus Treatment 6



What can be seen from Graph 4.10, upon intra-group analysis, is that there was a statistically significant difference of the mean Modified Schober's Test of group 2 for treatment 3 versus treatment 6 ($P<0.05$).

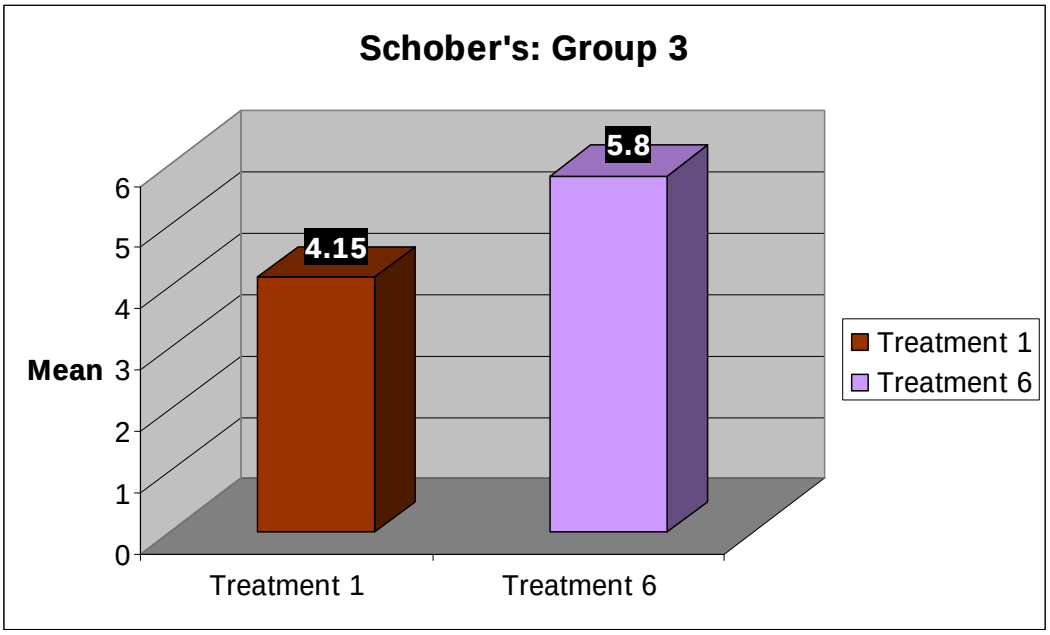
In summary of Group 2's modified Schober's test as seen in Graphs 4.8, 4.9 and 4.10 statistically significant values were established ($P<0.05$).

Graph 4.11 Modified Schober's Test Group 3: Treatment 1 versus Treatment 3



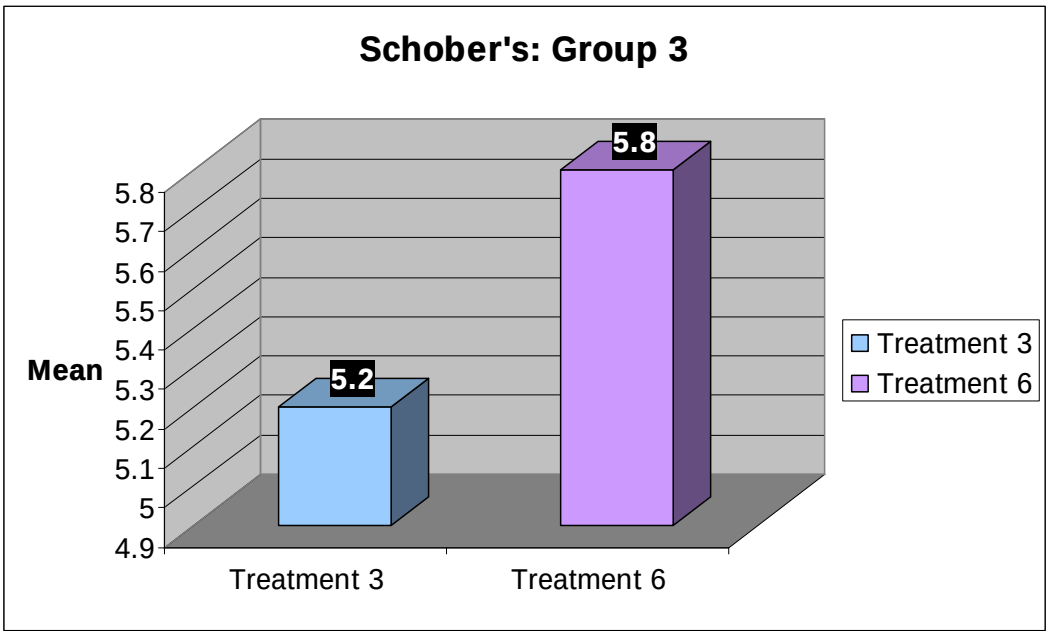
What can be seen from Graph 4.11, upon intra-group analysis, is that there was a statistically significant difference of the mean Modified Schober's Test of group 3 for treatment 1 versus treatment 3 ($P<0.05$).

Graph 4.12 Modified Schober's Test Group 3: Treatment 1 versus Treatment 6



What can be seen from Graph 4.12, upon intra-group analysis, is that there was a statistically significant difference of the mean Modified Schober's Test of group 3 for treatment 1 versus treatment 6 ($P<0.05$).

Graph 4.13 Modified Schober's Test Group 3: Treatment 3 versus Treatment 6

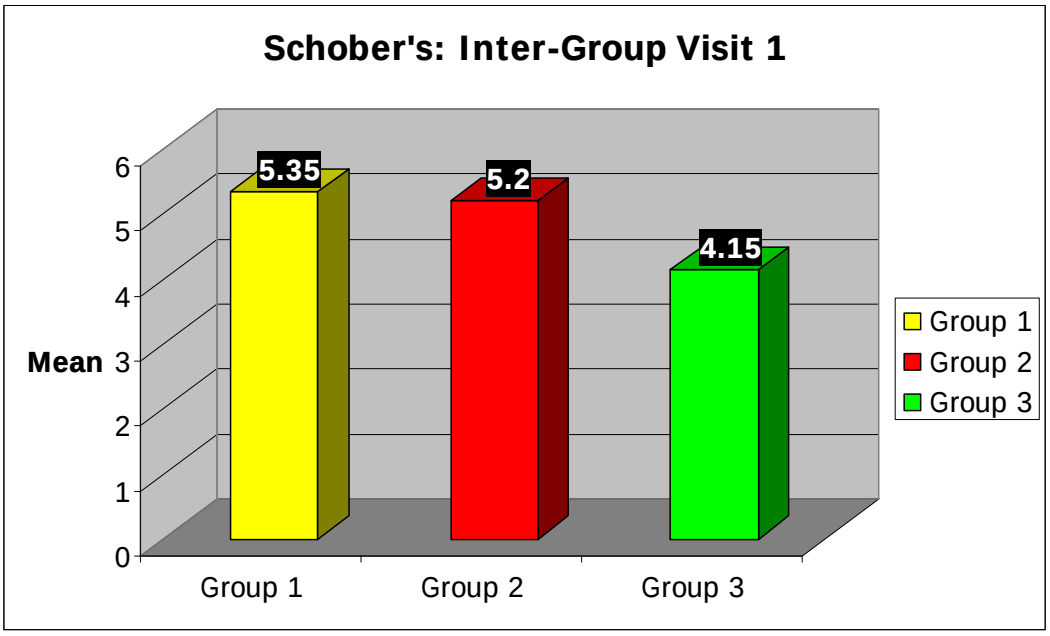


What can be seen from Graph 4.13, upon intra-group analysis, is that there was a statistically significant difference of the mean Modified Schober's Test of group 3 for treatment 3 versus treatment 6 ($P<0.05$).

In summary of Group 3's modified Schober's test as seen in Graphs 4.11, 4.12 and 4.13 statistically significant values were established ($P<0.05$).

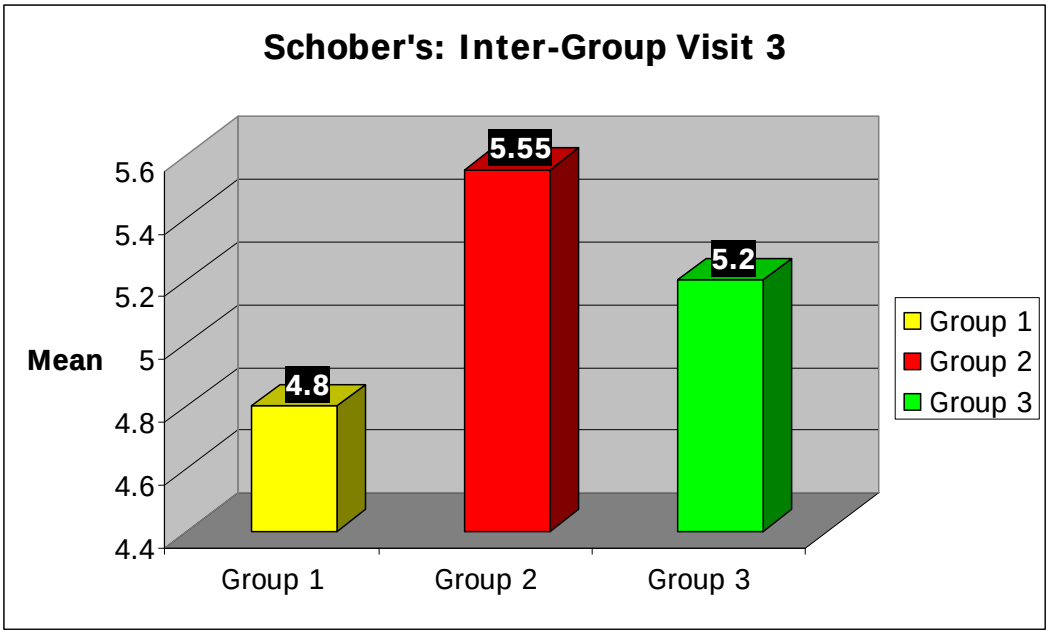
4.2.2. Statistical Analysis of Modified Schober's Test (Inter-group)

Graph 4.14 Modified Schober's Test: Visit 1



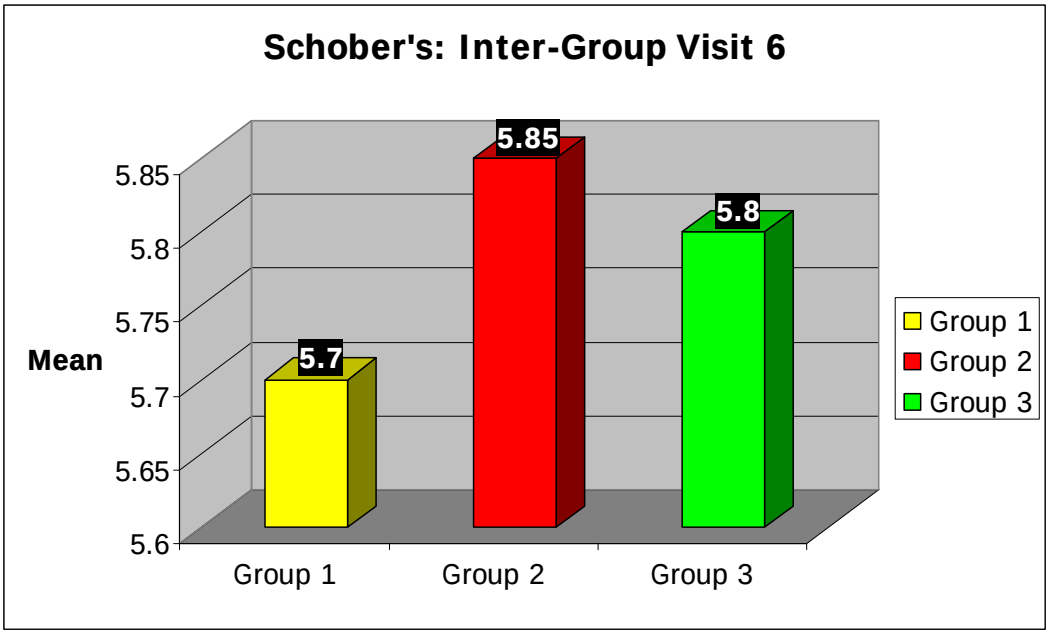
What can be seen from Graph 4.14, upon inter-group analysis, is that there were statistically significant differences of the mean Modified Schober's Test of group 1; group 2 and group 3 at visit 1 prior to the commencement of treatment ($P<0.05$).

Graph 4.15 Modified Schober's Test: Visit 3



What can be seen from Graph 4.15, upon inter-group analysis, is that there were no statistically significant differences of the mean Modified Schober's Test of group 1; group 2 and group 3 at visit 3 prior to the commencement of treatment ($P>0.05$).

Graph 4.16 Modified Schober's Test: Visit 6



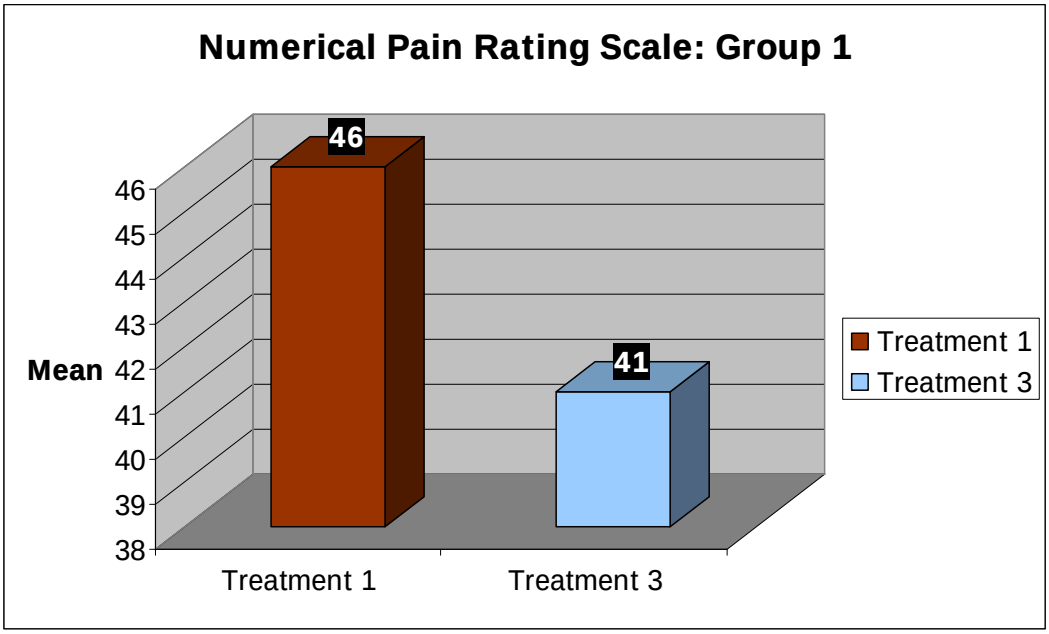
What can be seen from Graph 4.16, upon inter-group analysis, is that there were no statistically significant differences of the mean Modified Schober's Test of group 1; group 2 and group 3 at visit 6 prior, to the commencement of treatment ($P>0.05$).

In summary of the inter-group's Modified Schober's test as seen in Graphs 4.14, 4.15 and 4.16 no statistically significant values were established.

4.3. Subjective Data

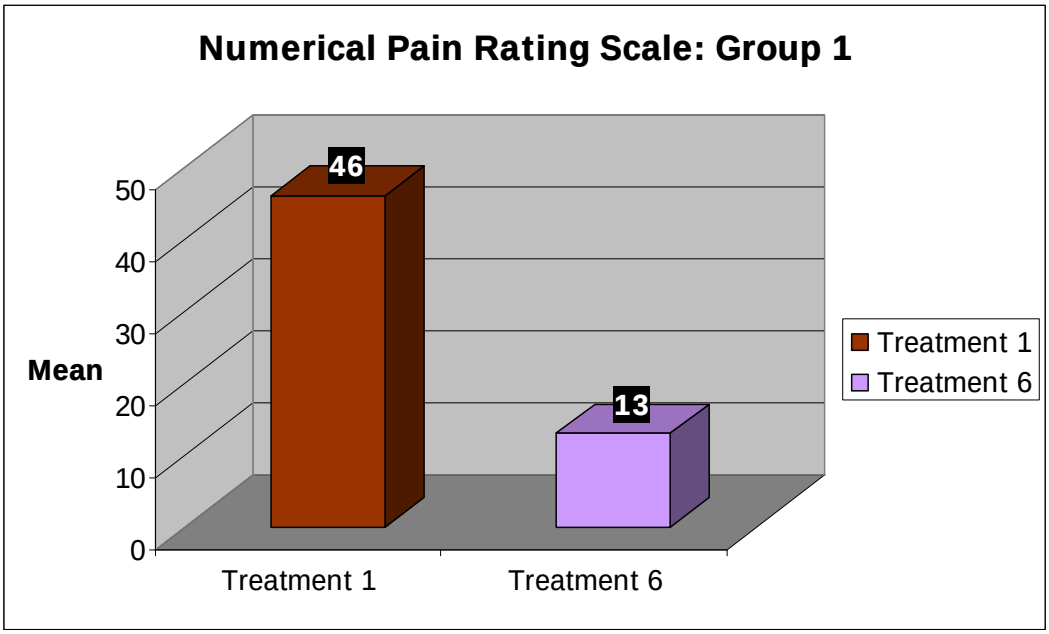
4.3.1. Statistical Analysis of the Numerical Pain Rating Scale (Intra-group)

Graph 4.17 Numerical Pain Rating Scale of Group 1: Treatment 1 versus Treatment 3



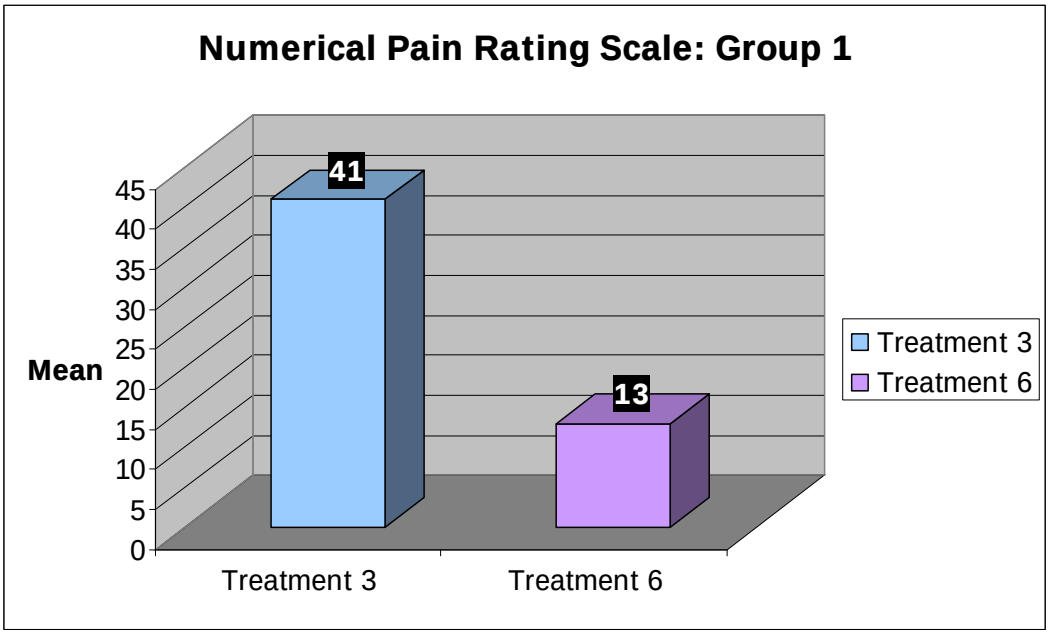
What can be seen from Graph 4.17, upon intra-group analysis, is that there was no statistically significant difference of the mean Numerical Pain Rating Scale (NPRS) of group 1 for treatment 1 versus treatment 3 ($P>0.05$).

Graph 4.18 Numerical Pain Rating Scale of Group 1: Treatment 1 versus Treatment 6



What can be seen from Graph 4.18, upon intra-group analysis, is that there was a statistically significant difference of the mean NPRS of group 1 for treatment 1 versus treatment 6 ($P<0.05$).

Graph 4.19 Numerical Pain Rating Scale of Group 1: Treatment 3 versus Treatment 6

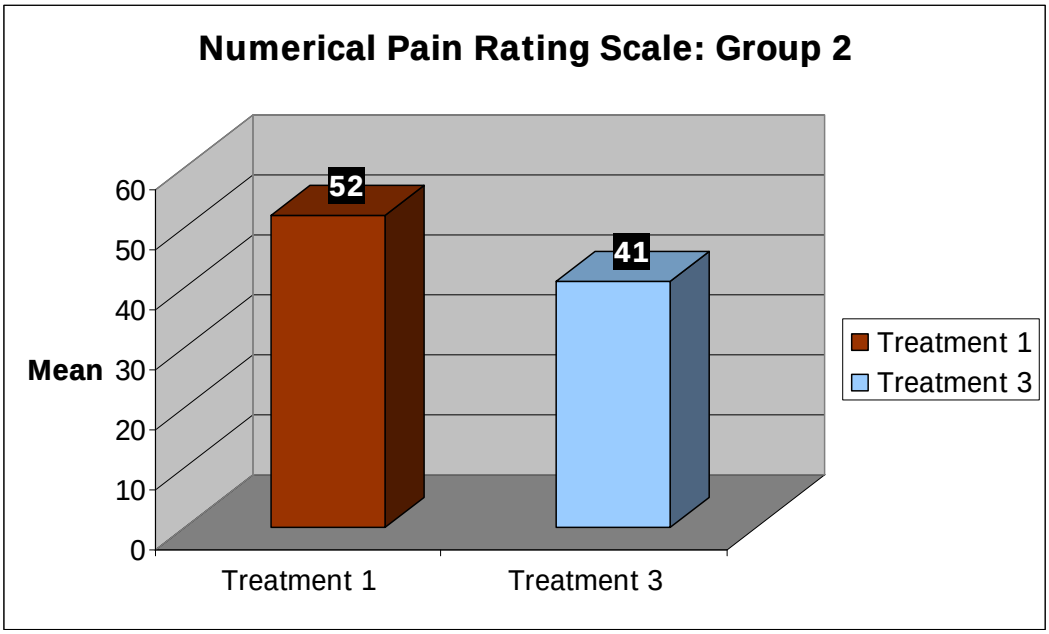


What can be seen from Graph 4.19, upon intra-group analysis, is that there was a statistically significant difference of the mean NPRS of group 1 for treatment 3 versus treatment 6 ($P<0.05$).

In summary of the group 1's NPRS as seen in Graph 4.17 no statistically significant value was established.

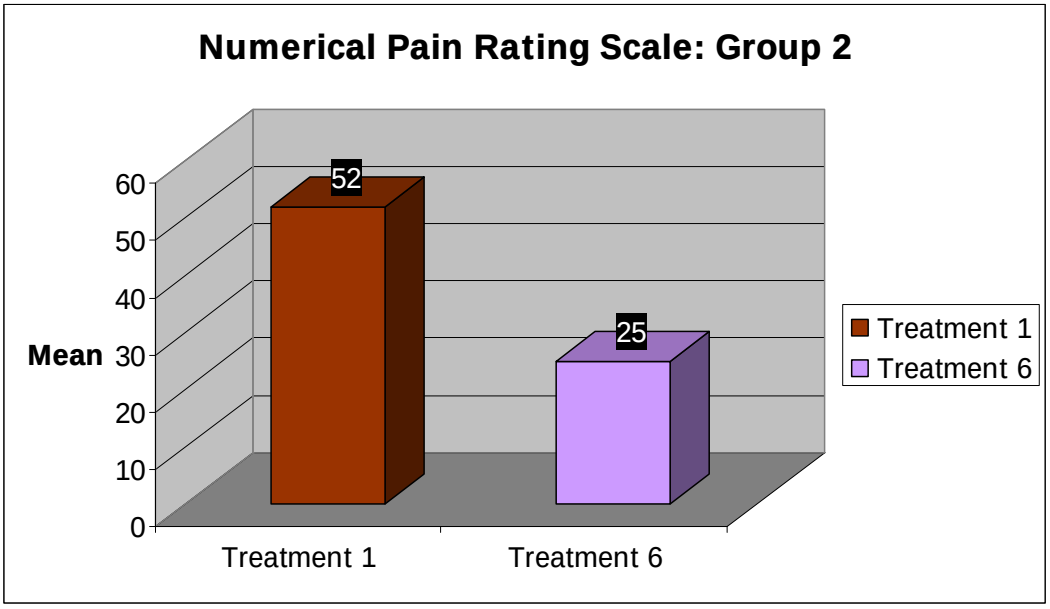
In summary of the group 1's NPRS as seen in Graphs 4.18 and 4.19 statistically significant values were established.

Graph 4.20 Numerical Pain Rating Scale of Group 2: Treatment 1 versus Treatment 3



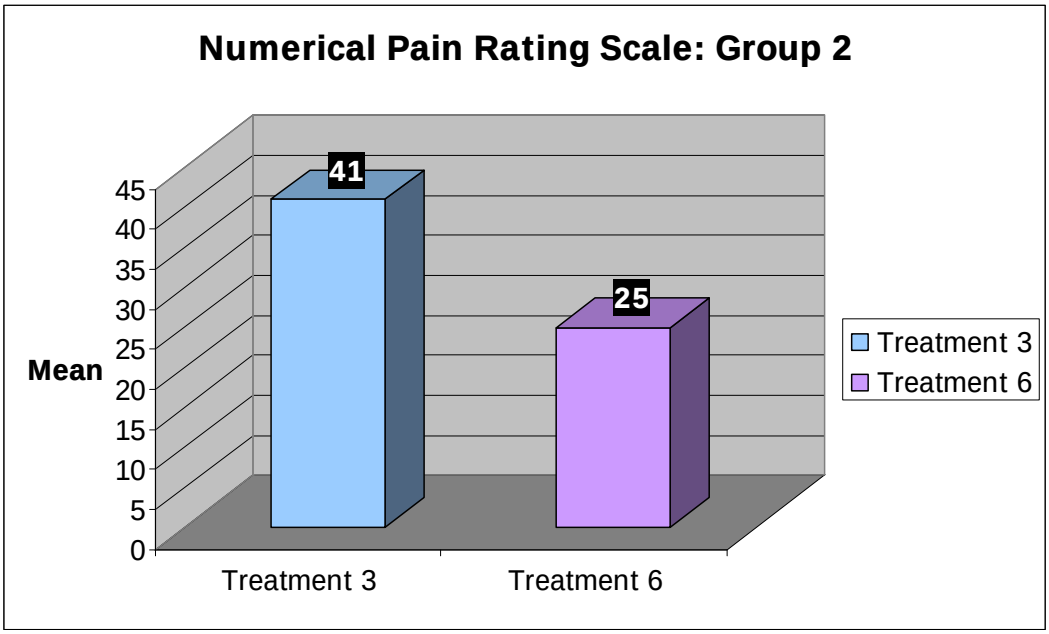
What can be seen from Graph 4.20, upon intra-group analysis, is that there was no statistically significant difference of the mean NPRS of group 2 for treatment 1 versus treatment 3 ($P>0.05$).

Graph 4.21 Numerical Pain Rating Scale of Group 2: Treatment 1 versus Treatment 6



What can be seen from Graph 4.21, upon intra-group analysis, is that there was a statistically significant difference of the mean NPRS of group 2 for treatment 1 versus treatment 6 ($P<0.05$).

Graph 4.22 Numerical Pain Rating Scale of Group 2: Treatment 3 versus Treatment 6

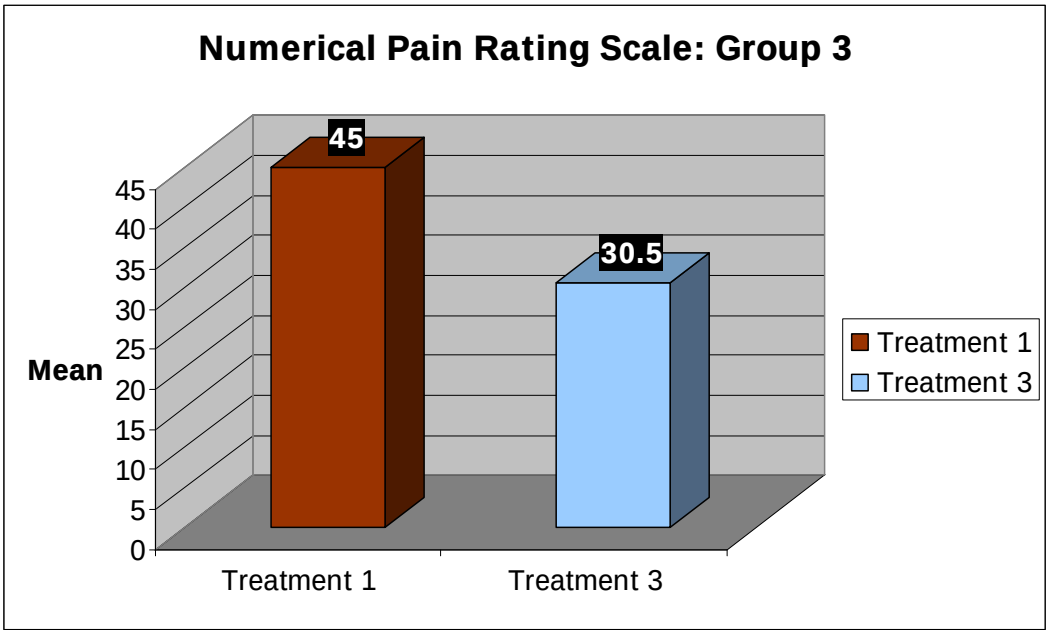


What can be seen from Graph 4.22, upon intra-group analysis, is that there was a statistically significant difference of the mean NPRS of group 2 for treatment 3 versus treatment 6 ($P<0.05$).

In summary of the group 2's NPRS as seen in Graph 4.20 no statistically significant value was established.

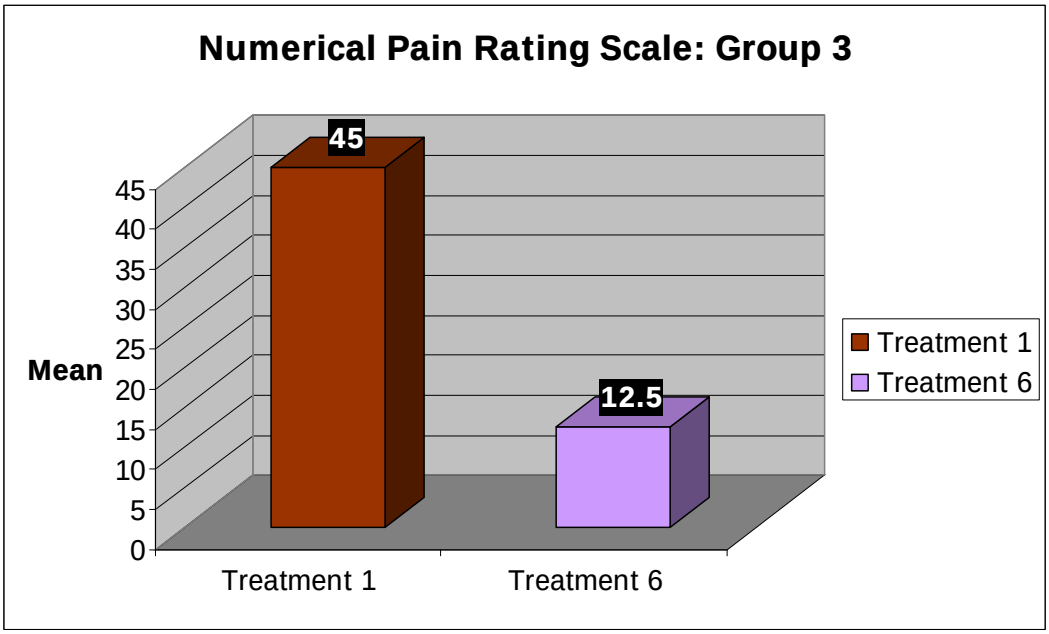
In summary of the group 2's NPRS as seen in Graphs 4.21 and 4.22 statistically significant values were established.

Graph 4.23 Numerical Pain Rating Scale of Group 3: Treatment 1 versus Treatment 3



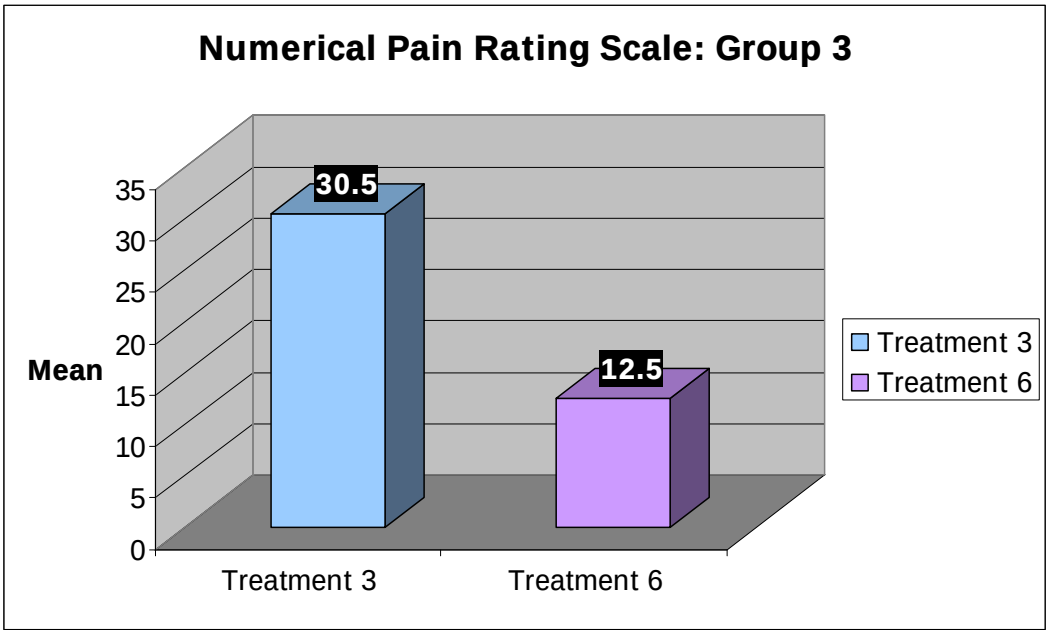
What can be seen from Graph 4.23, upon intra-group analysis, is that there was a statistically significant difference of the mean NPRS of group 3 for treatment 1 versus treatment 3 ($P<0.05$).

Graph 4.24 Numerical Pain Rating Scale of Group 3: Treatment 1 versus Treatment 6



What can be seen from Graph 4.24, upon intra-group analysis, is that there was a statistically significant difference of the mean NPRS of group 3 for treatment 1 versus treatment 6 ($P<0.05$).

Graph 4.25 Numerical Pain Rating Scale of Group 3: Treatment 3 versus Treatment 6

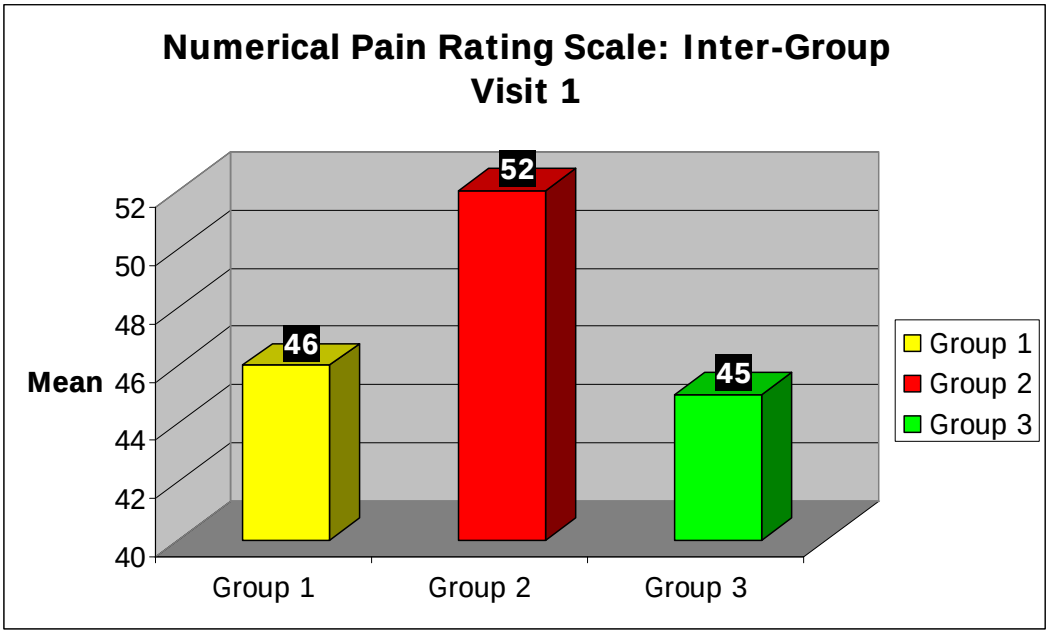


What can be seen from Graph 4.25, upon intra-group analysis, is that there was a statistically significant difference of the mean NPRS of group 3 for treatment 3 versus treatment 6 ($P<0.05$).

In summary of the group 3's Numerical Pain Rating Scale as seen in Graphs 4.23, 4.24, and 4.25, statistically significant values were established.

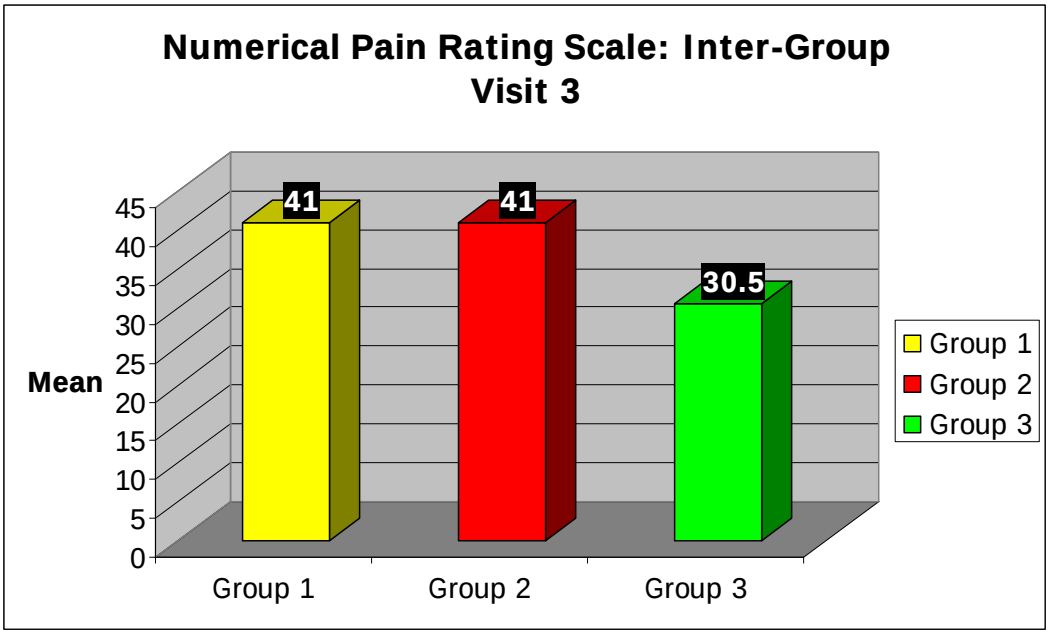
4.3.2. Statistical Analysis of the Numerical Pain Rating Scale (Inter-group)

Graph 4.26 Numerical Pain Rating Scale: Visit 1



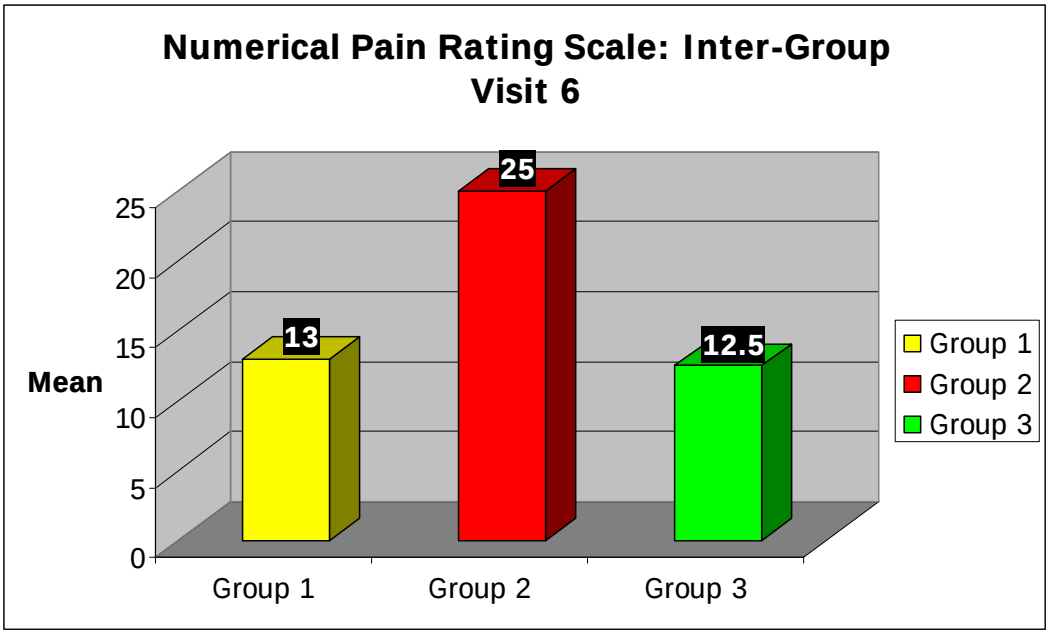
What can be seen from Graph 4.26, upon inter-group analysis, is that there were no statistically significant differences of the mean Numerical Pain Rating Scale (NPRS) of group 1; group 2 and group 3 at visit 1 prior to the commencement of treatment ($P>0.05$).

Graph 4.27 Numerical Pain Rating Scale: Visit 3



What can be seen from Graph 4.27, upon inter-group analysis, is that there were no statistically significant differences of the mean NPRS of group 1; group 2 and group 3 at visit 3 prior to the commencement of treatment ($P>0.05$).

Graph 4.28 Numerical Pain Rating Scale: Visit 6

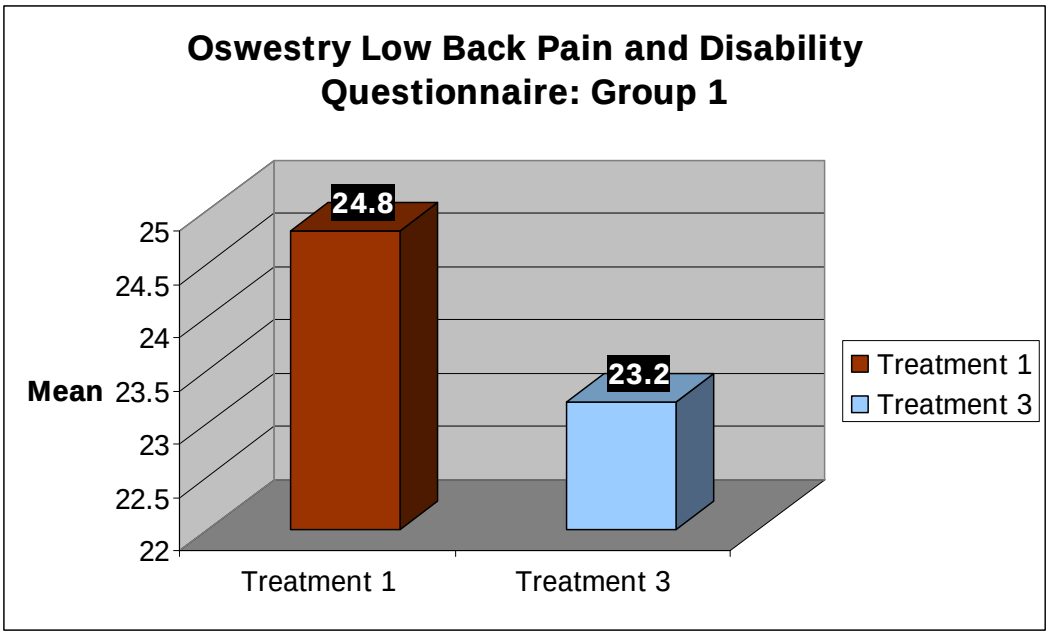


What can be seen from Graph 4.28, upon inter-group analysis, is that there were no statistically significant differences of the mean NPRS of group 1; group 2 and group 3 at visit 6 prior to the commencement of treatment ($P>0.05$).

In summary of the inter-group's NPRS as seen in Graphs 4.26, 4.27 and 4.28 no statistically significant values were established.

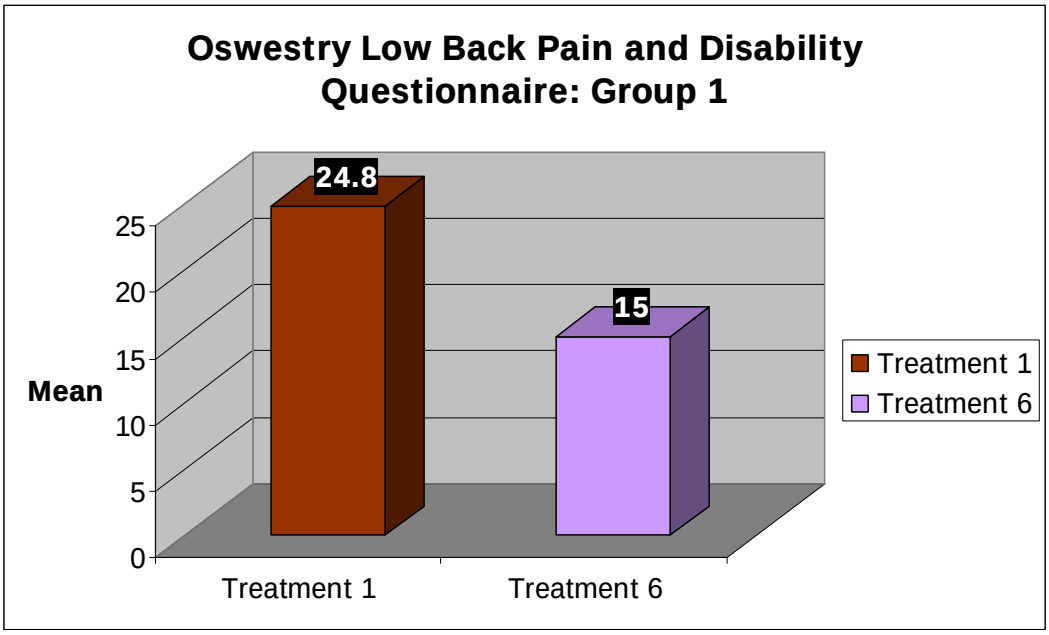
4.3.3. Statistical Analysis of the Oswestry Low Back Pain and Disability Questionnaire (Intra-group)

Graph 4.29 Oswestry Low Back Pain and Disability Questionnaire of Group 1: Treatment 1 versus Treatment 3



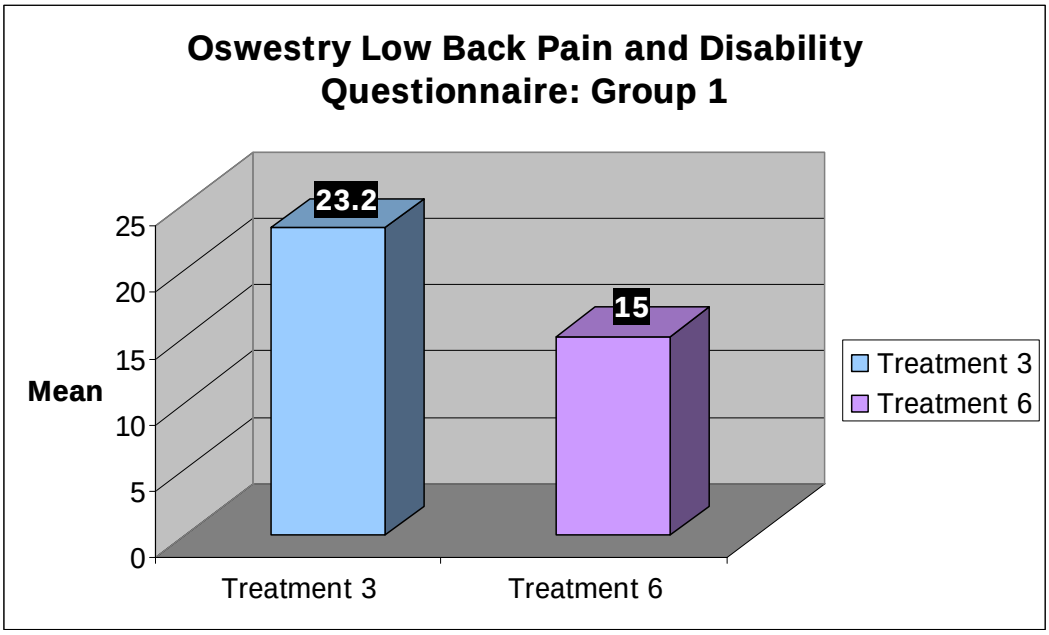
What can be seen from Graph 4.29, upon intra-group analysis, is that there was no statistically significant difference of the mean Oswestry Low Back Pain and Disability Questionnaire of group 1 for treatment 1 versus treatment 3 ($P>0.05$).

Graph 4.30 Oswestry Low Back Pain and Disability Questionnaire of Group 1: Treatment 1 versus Treatment 6



What can be seen from Graph 4.30, upon intra-group analysis, is that there was no statistically significant difference of the mean Oswestry Low Back Pain and Disability Questionnaire of group 1 for treatment 1 versus treatment 6 ($P>0.05$).

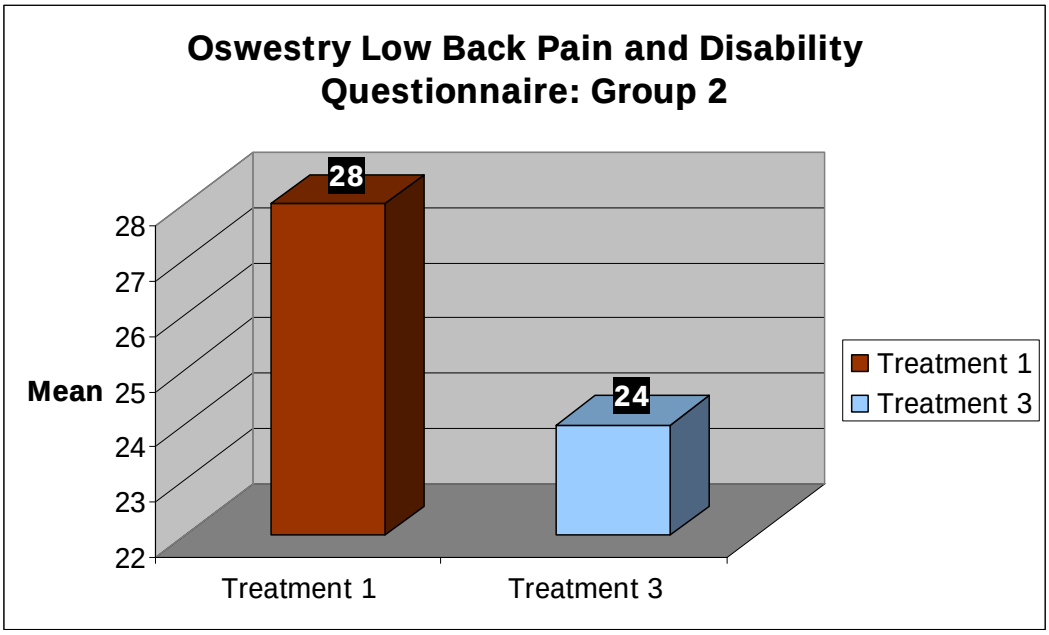
Graph 4.31 Oswestry Low Back Pain and Disability Questionnaire of Group 1: Treatment 3 versus Treatment 6



What can be seen from Graph 4.31, upon intra-group analysis, is that there was no statistically significant difference of the mean Oswestry Low Back Pain and Disability Questionnaire of group 1 for treatment 3 versus treatment 6 ($P>0.05$).

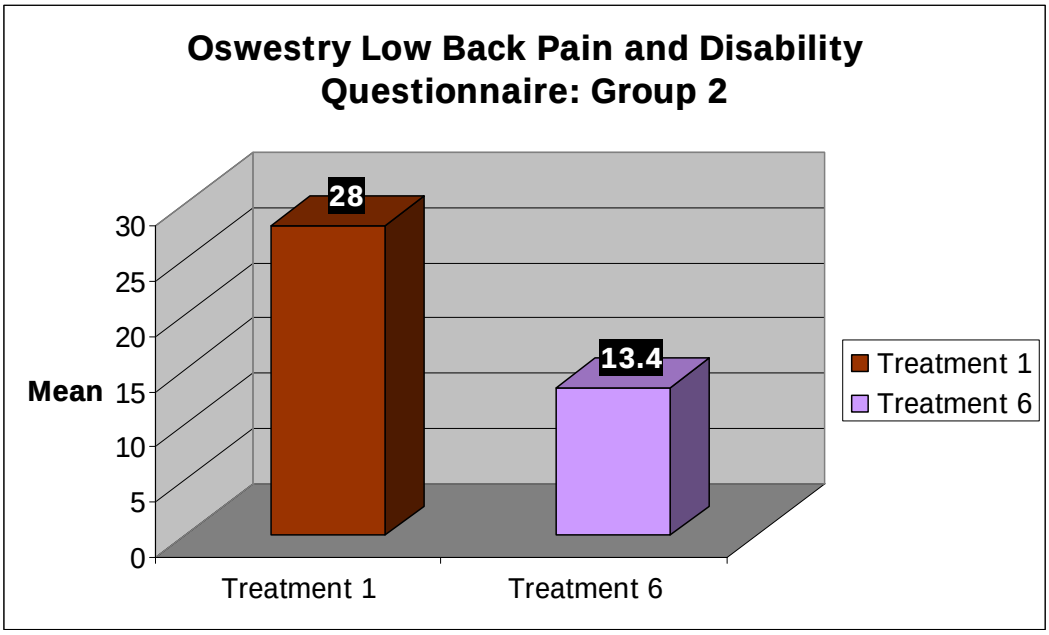
In summary of the group 1's Oswestry Low Back Pain and Disability Questionnaire as seen in Graph 4.29, 4.30 and 4.31 no statistically significant values were established.

Graph 4.32 Oswestry Low Back Pain and Disability Questionnaire of Group 2: Treatment 1 versus Treatment 3



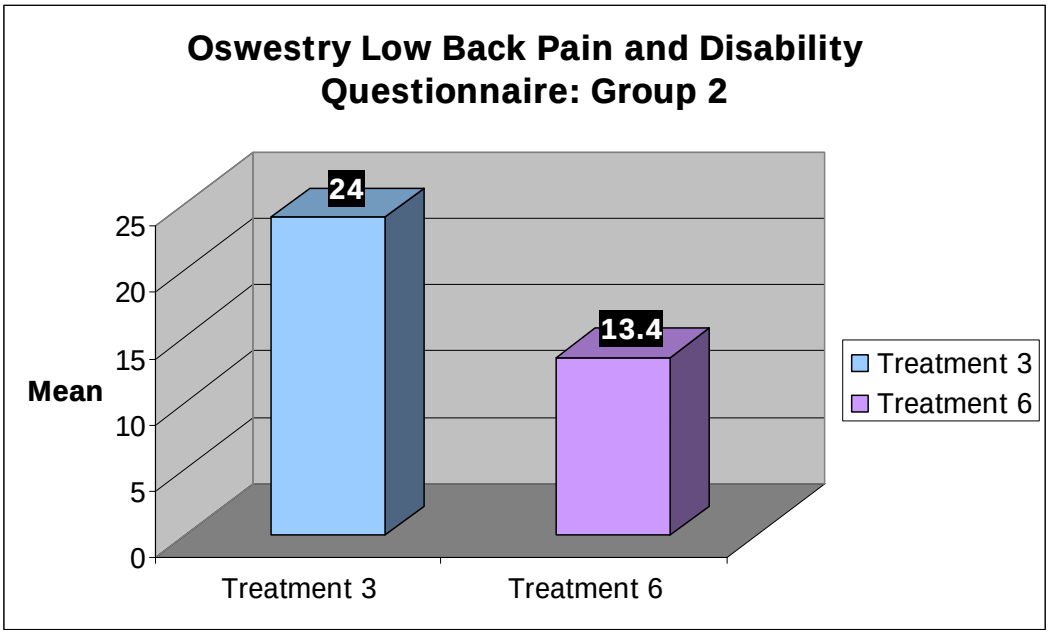
What can be seen from Graph 4.32, upon intra-group analysis, is that there was no statistically significant difference of the mean Oswestry Low Back Pain and Disability Questionnaire of group 2 for treatment 1 versus treatment 3 ($P>0.05$).

Graph 4.33 Oswestry Low Back Pain and Disability Questionnaire of Group 2: Treatment 1 versus Treatment 6



What can be seen from Graph 4.33, upon intra-group analysis, is that there was a statistically significant difference of the mean Oswestry Low Back Pain and Disability Questionnaire of group 2 for treatment 1 versus treatment 6 ($P<0.05$).

Graph 4.34 Oswestry Low Back Pain and Disability Questionnaire of Group 2: Treatment 3 versus Treatment 6

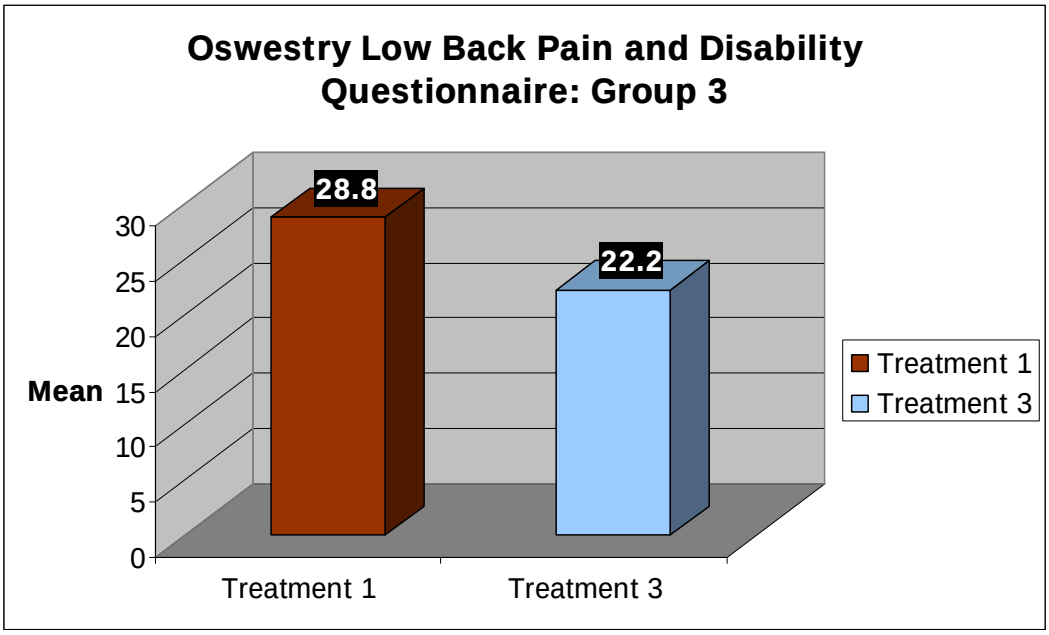


What can be seen from Graph 4.34, upon intra-group analysis, is that there was a statistically significant difference of the mean Oswestry Low Back Pain and Disability Questionnaire of group 2 for treatment 3 versus treatment 6 ($P<0.05$).

In summary of the group 2's Oswestry Low Back Pain and Disability Questionnaire as seen in Graph 4.32 no statistically significant value was established.

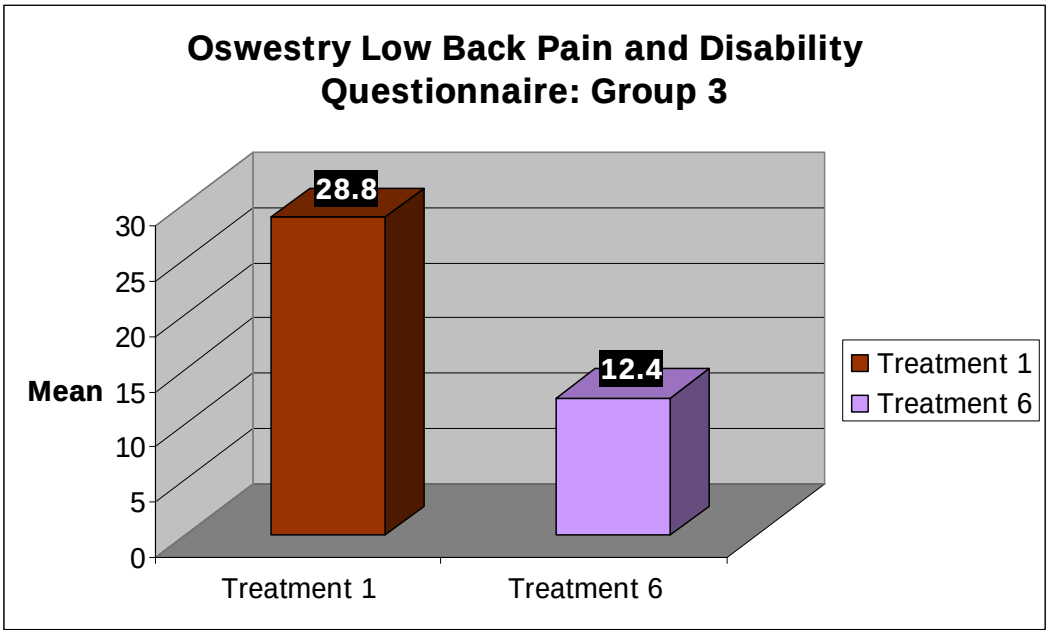
In summary of the group 2's Oswestry Low Back Pain and Disability Questionnaire as seen in Graphs 4.33 and 4.34 statistically significant values were established.

Graph 4.35 Oswestry Low Back Pain and Disability Questionnaire of Group 3: Treatment 1 versus Treatment 3



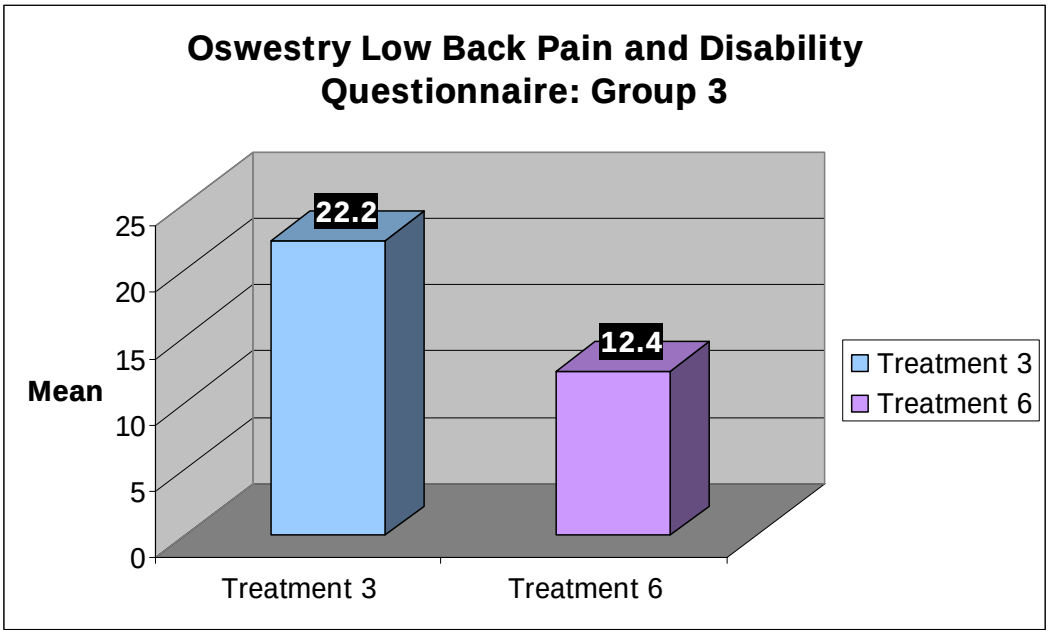
What can be seen from Graph 4.35, upon intra-group analysis, is that there was no statistically significant difference of the mean Oswestry Low Back Pain and Disability Questionnaire of group 3 for treatment 1 versus treatment 3 ($P>0.05$).

Graph 4.36 Oswestry Low Back Pain and Disability Questionnaire of Group 3: Treatment 1 versus Treatment 6



What can be seen from Graph 4.36, upon intra-group analysis, is that there was a statistically significant difference of the mean Oswestry Low Back Pain and Disability Questionnaire of group 3 for treatment 1 versus treatment 6 ($P<0.05$).

Graph 4.37 Oswestry Low Back Pain and Disability Questionnaire of Group 3: Treatment 3 versus Treatment 6



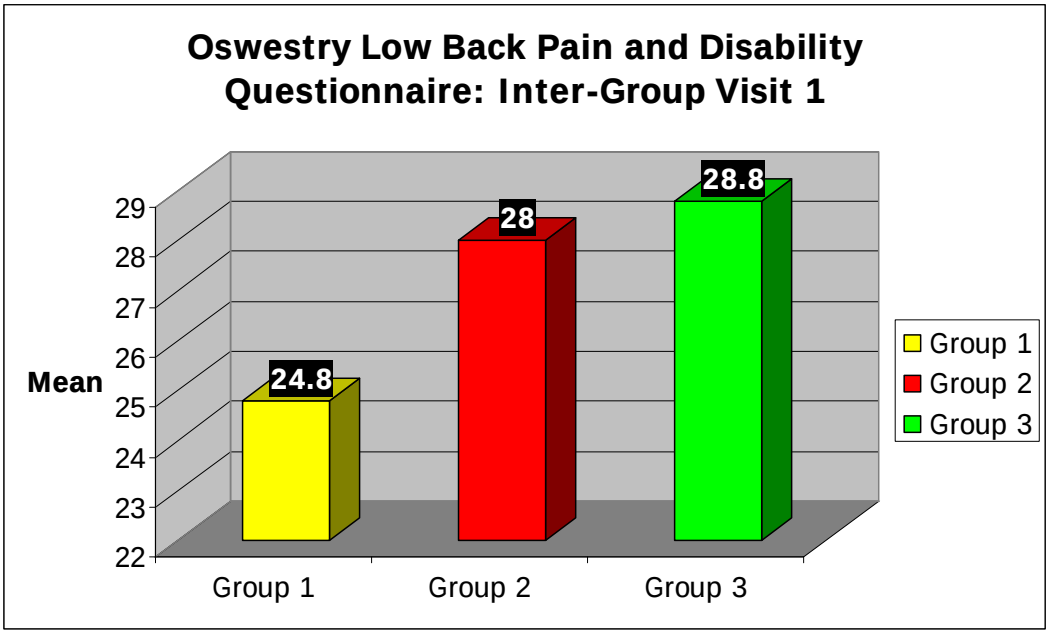
What can be seen from Graph 4.37, upon intra-group analysis, is that there was a statistically significant difference of the mean Oswestry Low Back Pain and Disability Questionnaire of group 3 for treatment 3 versus treatment 6 ($P<0.05$).

In summary of the group 3's Oswestry Low Back Pain and Disability Questionnaire as seen in Graph 4.35 no statistically significant value was established.

In summary of the group 2's Oswestry Low Back Pain and Disability Questionnaire as seen in Graphs 4.36 and 4.37 statistically significant values were established.

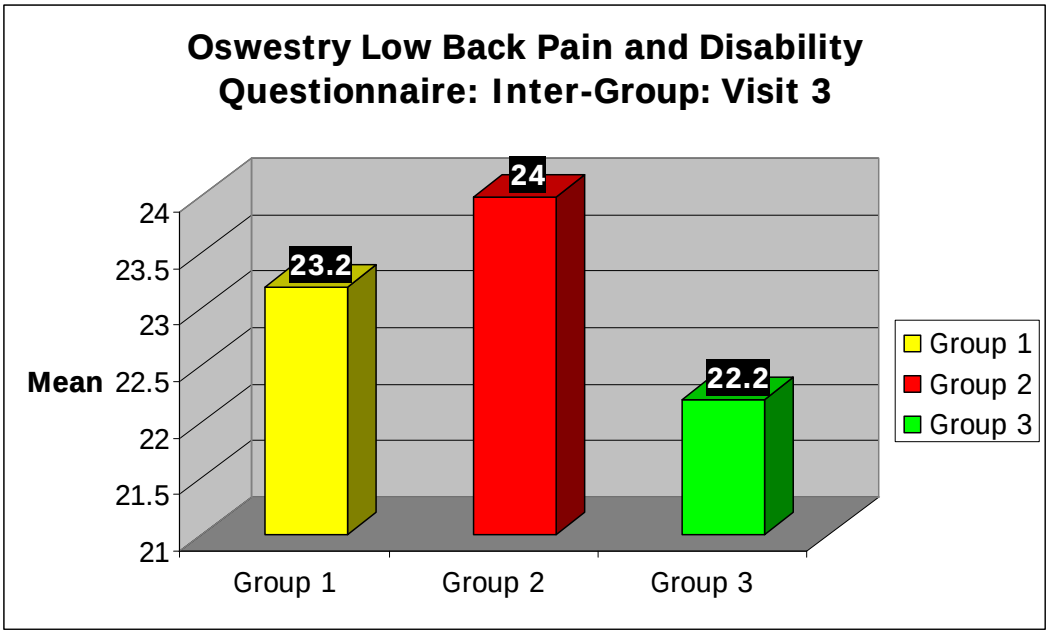
4.3.4. Statistical Analysis of the Oswestry Low Back Pain and Disability Questionnaire (Inter-group)

Graph 4.38 Oswestry Low Back Pain and Disability Questionnaire: Visit 1



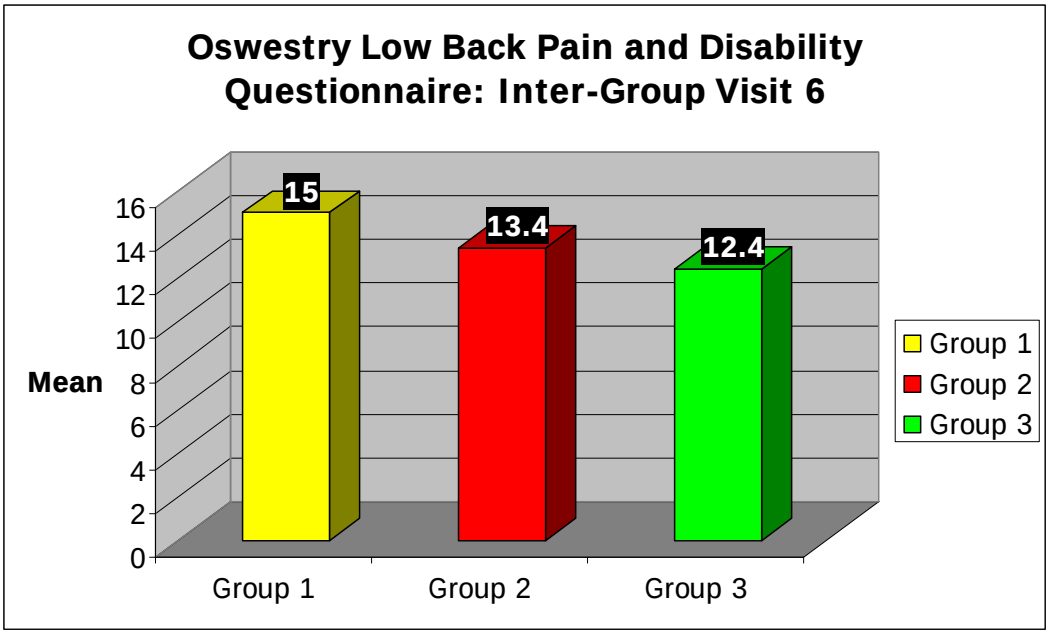
What can be seen from Graph 4.38, upon inter-group analysis, is that there were no statistically significant differences of the mean Oswestry Low Back Pain and Disability Questionnaire of group 1; group 2 and group 3 at visit 1 prior to the commencement of treatment ($P>0.05$).

Graph 4.39 Oswestry Low Back Pain and Disability Questionnaire: Visit 3



What can be seen from Graph 4.39, upon inter-group analysis, is that there were no statistically significant differences of the mean Oswestry Low Back Pain and Disability Questionnaire of group 1; group 2 and group 3 at visit 3 prior to the commencement of treatment ($P>0.05$).

Graph 4.40 Oswestry Low Back Pain and Disability Questionnaire: Visit 6



What can be seen from Graph 4.40, upon inter-group analysis, is that there were no statistically significant differences of the mean Oswestry Low Back Pain and Disability Questionnaire of group 1; group 2 and group 3 at visit 6 prior to the commencement of treatment ($P>0.05$).

In summary of the inter-group's Oswestry Low Back Pain and Disability Questionnaire as seen in Graphs 4.38, 4.39 and 4.40 no statistically significant values were established.

Chapter 5: Discussion

This chapter involves the examination and discussion of the objective and subjective results presented in chapter four. These results were obtained from statistical analysis of the Modified Schober's test, Numerical Pain Rating Scale (NPRS) and the Oswestry Low Back Pain and Disability Questionnaire. The demographic data presented and analysed in chapter four was collected from each patient during their first examination and treatment.

5.1. Demographic Characteristics

Due to the nature of this study, effective treatment of post-partum low back pain, all patients examined were female.

The age distribution of the full sample group ranged from 20-42 years of age. The youngest person was 20 years old from group 1 while the oldest was 42 years from group 2. The results showed that the mean age of group 1 was 30.6 years of age, the mean age of group 2 was 34.8 years of age and the mean age of group 3 was 32.8 years of age (Graph 4.1). Although there is a difference of mean age of 4.2 years between group 1 and group 3 no statistically significant difference were noted between the groups ($P>0.05$).

The height distribution of the full sample group ranged from 1.50-1.76 metres. The results showed that the mean height for group 1 was 1.653metres, the mean height for group 2 was 1.629metres and the mean height for group 3 was 1.671metres (Graph 4.2). The shortest person was found in group 1 and was 1.50 metres while in group 2 the tallest person was 1.76 metres. The results showed that there was a mean height difference of 0.022metres between group 2 and group 3 .No statistically significant difference in inter-group mean height analysis were noted ($P>0.05$).

The weight distribution of the full sample group ranged from 51-105 kilograms. The results showed that the mean weight of group 1 was 69.95 kilograms; the mean weight of group 2 was 66.90 kilograms and the mean weight for group 3 was 61.60 kilograms (Graph 4.3). Although there was nearly a 10 kilogram difference between group 1 and group 3 no statistically significant differences were found between the groups ($P>0.05$).

The body mass index (BMI) for inter-group analysis showed a mean BMI for group 1 of 25.612, for group 2 of 24.772 and for group 3 of 22.0534 (Graph 4.4). No statistically significant difference in the inter-group mean BMI was noted ($P>0.05$).

Although no statistically significant differences were noted on inter-group analysis of mean demographics for group 1, group 2 and group 3; this is significant because it shows that all the groups were of similar weight, height, age and body mass index when this study commenced.

5.2. Objective results

5.2.1. Modified Schober's Test (Intra-group)

On examination of group 1's Modified Schober's test intra-group analysis; Graphs 4.5, 4.6 and 4.7 for visit 1 versus visit 3, visit 1 versus visit 6 and visit 3 versus visit 6 respectively. The mean length at visit 1 was 5.35cm, the mean length at visit 3 was 4.80cm and the mean length at visit 6 was 5.70cm. Although there was a decrease in the mean length of Schober's from visit 1 to visit 3 (Graph 4.5) overall from visit 1 to visit 6 there was an increase in the Schober's measurement. There was no statistically significant difference on intra-group analysis of group 1 ($P>0.05$).

Although there was no statistically significant difference, it must be noted, that there was an overall improvement of 0.35cm from treatment one to treatment six for group 1.

On examination of group 2's Modified Schober's test intra-group analysis; Graphs 4.8, 4.9 and 4.10 for visit 1 versus visit 3, visit 1 versus visit 6 and visit 3 versus visit 6 respectively. The mean length at visit 1 was 5.20cm, the mean length at visit 3 was 5.55cm and the mean length at visit 6 was 5.85cm. There was an overall increase in the mean length of Schober's from visit 1 to visit 6 and thus there was a statistically significant difference seen at visit 1 versus visit 3 (P=0.001) visit 1 versus visit 6 (P=0.002) and visit 3 versus visit 6 (P=0.024). The overall increase in the mean length of Schober's for group 2 treatment one to treatment six was calculated at 0.65cm.

On examination of group 3's Modified Schober's test intra-group analysis; Graphs 4.11, 4.12 and 4.13 for visit 1 versus visit 3, visit 1 versus visit 6 and visit 3 versus visit 6 respectively. The mean length at visit 1 was 4.15cm, the mean length at visit 3 was 5.20cm and the mean length at visit 6 was 5.80cm. There was an overall increase in the mean length of Schober's from visit 1 to visit 6 and thus there was a statistically significant difference seen at visit 1 versus visit 3 (P=0.005), visit 1 versus visit 6 (P=0.001) and visit 3 versus visit 6 (P=0.037).
Here it must be noted that the overall increase in the mean length of Schober's for group 3 treatment one to treatment six was calculated at 1.65cm.

Although all three groups responded positively, group 3 had the largest improvement of 1.65cm in forward flexion testing using the Modified Schober's test.

Group 1 responded well because joint mobility was restored to the sacroiliac joint this in turn lead to an increase in range of motion in the sacroiliac joint, which effects the lumbar spine range of motion; the spine always functions as a unit (S. Haldeman; 2000).

Janda (1987) surmised that exercise is essential in the rehabilitation and management of patients with low back and pelvic pain, this theory would explain why group 2, whose treatment protocol was slow dynamic strengthening exercise of the sacroiliac joints and pelvis, also had an increase in the mean length of Schober's.

Group 3's response to the treatment was superior to both group 1's treatment of the adjustment alone; and group 2's treatment of slow dynamic strengthening exercises only. This is due to group 3's combined treatment of slow dynamic strengthening exercise and adjustment of the sacroiliac joint. Normalisation of aberrant joint function and muscle strengthening is considered the most effective way to reduced low back pain in patients (Journal of Canadian Chiropractic Association; 1997).

5.2.2. Modified Schober's Test (Inter-group)

On inter-group analysis of the Modified Schober's test Graph 4.14 at visit 1 it was noted that there was a statistically significant difference of the mean length between group 1 (mean length 5.35cm); group 2 (mean length 5.20cm) and group 3 (mean length 4.15cm) where P=0.013. This shows that prior to the commencement of the first treatment there was more than a 10% difference between the groups.

On inter-group analysis of the Modified Schober's test Graph 4.15 at visit 3 there was no statistically significant difference noted between the groups ($P>0.05$).

This showed that by the third visit the mean length of Schober's test for group 1 (mean length 4.80cm); group 2 (mean length 5.55cm) and group 3 (mean length 5.20cm) were more comparable.

What can be seen from Graph 4.16, upon inter-group analysis, is that there was no statistically significant difference of the mean Modified Schober's test between all the groups at visit 6 ($P>0.05$).
The mean length of group 1 (mean length 5.70cm); group 2 (mean length 5.85cm) and group 3 (mean length 5.80cm) were virtually the same; although group 3 still showed the largest improvement.

This inter-group analysis showed that all the treatment protocols were valuable, as all the groups Modified Schober's test mean lengths improved. Inter-group improvement of group 1 and group 3 can be explained by using the reflex theory of an adjustment; that an introduction of a mechanical force into the spine or sacroiliac joints will affect muscles and joints which would increase range of motion of the spine as a whole (J. G. Pickar, J. D. Wheeler; 2001).

Group 2's improvement can be explained by linking increased muscular strength and slow dynamic strengthening techniques, with increased range of motion and pain reduction (M.L. Pollock *et al*.; 1989).

5.3. Subjective results

5.3.1. Numerical Pain Rating Scale (Intra-group)

On examination of group 1's Numerical Pain Rating Scale (NPRS) intra-group analysis; Graphs 4.17, 4.18 and 4.19 for visit 1 versus visit 3, visit 1 versus visit 6 and visit 3 versus visit 6 respectively; the mean percentage pain experienced at visit 1 was 46%, at visit 3 was 41% and the at visit 6 was 13%.

Although there was a slight decrease in the mean percentage pain from visit 1 to visit 3.50% decrease (Graph 4.17), the most marked decrease in the mean percentage pain was from visit 1 to visit 6 (Graph 4.18) with a mean percentage pain decrease of 33%. This 33% decrease was statistically significant with P=0.01.Visit 3 to visit 6 (Graph 4.19) also showed a mean percentage pain decrease of 28% and was also statistically significant with P=0.001.
Therefore subjectively from visit 1 to visit 6 there was a marked subjective improvement of group 1's mean percentage pain.

On examination of group 2's NPRS intra-group analysis; Graphs 4.20, 4.21 and 4.22 for visit 1 versus visit 3, visit 1 versus visit 6 and visit 3 versus visit 6 respectively; the mean percentage pain experienced at visit 1 was 52%, at visit 3 was 41% and the at visit 6 was 25%. Although there was a slight decrease in the mean percentage pain from visit 1 to visit 3, 11% decrease (Graph 4.20), the most marked decrease in the mean percentage pain was from visit 1 to visit 6 (Graph 4.21) with a mean percentage pain decrease of 27%. This 27% decrease was statistically significant with P=0.002.Visit 3 to visit 6 (Graph 4.22) also showed a mean percentage pain decrease of 16% and was also statistically significant with P=0.001. Therefore subjectively from visit 1 to visit 6 there was an overall improvement of group 2's mean percentage pain.

On examination of group 3's NPRS intra-group analysis; Graphs 4.23, 4.24 and 4.25 for visit 1 versus visit 3, visit 1 versus visit 6 and visit 3 versus visit 6 respectively; the mean percentage pain experienced at visit 1 was 45%, at visit 3 was 30.50% and the at visit 6 was 12.50%. There was a decrease in the mean percentage pain from visit 1 to visit 3, 14.50% decrease (Graph 4.23), the most marked decrease in the mean percentage pain was from visit 1 to visit 6 (Graph 4.24) with a mean percentage pain decrease of 32.50%.

This 32.50% decrease was statistically significant with P=0.001.Visit 1 to visit 3 (Graph 4.23) also showed a mean percentage pain decrease of 14.50% and was also statistically significant with P=0.002.
Therefore subjectively from visit 1 to visit 6 there was an overall improvement of group 3's mean percentage pain.

On examination of these Graphs over a six treatment protocol, group 1 had the greatest reduction in mean percentage pain of 33%.
Group 1 was closely followed by group 3 with a mean percentage pain reduction of 32.50% and group 2 with a 27% mean percentage pain reduction. This showed that all the groups responded well, subjectively, but group 1 and group 3 had the most marked percentage pain reduction.

This can be explained using the nociceptors effect of the adjustment which theorises that a specific chiropractic manipulation to correct aberrant joint function will relieve pain with the removal of noxious stimulus (D. Chapman-Smith; 1989).
This is why group 1 and group 3 who received sacroiliac adjustments responded better than group 2 who received only core stabilisation exercises.

5.3.2. Numerical Pain Rating Scale (Inter-group)

In summary of the inter-group's NPRS as seen in Graphs 4.26, 4.27 and 4.28 no statistically significant values were established ($P>0.05$).

This inter-group examination showed that all the groups responded satisfactorily to the treatment protocols, as all the groups mean percentage pain and disability decreased. The greatest improvement occurred between visit 3 and visit six as group 1 (41% reduced to 13%) group 2 (52% reduced to 25%) and group 3 (45% reduced to 12.50%).

Inter-group analysis also showed that although the groups mean percentage pain began at relatively similar percentages group 1 (mean percentage pain of 13%) and group 3 (mean percentage pain of 12.50%) final values were superior to that of group 2 (mean percentage pain 25%). Therefore, subjectively, on inter-group analysis group 3 responded the best.

5.3.3. Oswestry Lower Back Pain and Disability Questionnaire (Intra-group)

On intra-group analysis, it can be seen that Graphs 4.29, 4.30 and 4.31 illustrated that there was no statistically significant difference of the mean Oswestry Low Back Pain and Disability Questionnaire of group 1 for treatment 1 through treatment 6 ($P>0.05$).
However group 1 did show a gradual decrease in the mean percentage pain and disability from visit 1 to visit 6. The mean percentage pain experienced at visit 1 was 24.80%, at visit 3 was 23.20% and at visit 6 was 15%. Therefore this was an overall subjective improvement of 9.80%.

On examination of group 2's Oswestry Low Back Pain and Disability Questionnaire intra-group analysis; Graphs 4.32, 4.33 and 4.34 for visit 1 versus visit 3, visit 1 versus visit 6 and visit 3 versus visit 6 respectively; the mean percentage pain and disability experienced at visit 1 was 28%, at visit 3 was 24% and the at visit 6 was 13.40%. Although there was a slight decrease in the mean percentage pain and disability from visit 1 to visit 3, 4% decrease (Graph 4.32), the most marked decrease in the mean percentage pain and disability was from visit 1 to visit 6 (Graph 4.33) with a mean percentage pain and disability decrease of 14.60%. This 14.60% decrease was statistically significant with P=0.009.Visit 3 to visit 6 (Graph 4.34) also showed a mean percentage pain decrease of 10.60% and was also statistically significant with P=0.012. Therefore subjectively from visit 1 to visit 6 there was an overall improvement of group 2's mean percentage pain and disability of 14.60%.

On assessment of group 3's Oswestry Low Back Pain and Disability Questionnaire intra-group analysis; Graphs 4.35, 4.36 and 4.37 for visit 1 versus visit 3, visit 1 versus visit 6 and visit 3 versus visit 6 respectively; the mean percentage pain and disability experienced at visit 1 was 28.80%, at visit 3 was 22.20% and the at visit 6 was 12.40%.

Although there was a slight decrease in the mean percentage pain and disability from visit 1 to visit 3, 6.60% decrease (Graph 4.35), the most marked decrease in the mean percentage pain and disability was from visit 1 to visit 6 (Graph 4.36) with a mean percentage pain and disability decrease of 16.40%. This 16.40% decrease was statistically significant with P=0.000.Visit 3 to visit 6 (Graph 4.37) also showed a mean percentage pain decrease of 9.80% and was also statistically significant with P=0.001. Therefore subjectively from visit 1 to visit 6 there was an overall improvement of group 3's mean percentage pain and disability of 16.40%.

This intra-group analysis showed that all three groups responded to the treatment protocols, as all the groups mean percentage pain and disability decreased. The greatest improvement occurred between visit 3 and visit six as group 1 (23.20% reduced to 15%) group 2 (24% reduced to 13.40%) and group 3 (22.20% reduced to 12.40%). Group 3 responded the best with an overall reduction in the mean percentage pain and disability from visit 1 to visit 6 of 16.40% whereas group 2 was 14.60% and group 1 was only 9.80%.

5.3.4. Oswestry Lower Back Pain and Disability Questionnaire (Inter-group)

In summary of the inter-group analysis of the Oswestry Low Back Pain and Disability Questionnaires as seen in Graphs 4.38, 4.39 and 4.40 no statistically significant values were established ($P>0.05$).

This inter-group examination showed that all the groups responded to the three different treatment protocols positively, as all the groups' mean percentage pain and disability decreased.

The most marked decrease in mean pain and disability occurred between visit 3 and visit six as group 1 (23.20% reduced to 15%) group 2 (24% reduced to 13.40%) and group 3 (22.20% reduced to 12.40%).
This inter-group analysis showed that although the groups' mean percentage pain and disability began at relatively similar percentages the final values for group 2 (mean percentage pain and disability of 13.40%) and group 3 (mean percentage pain of 12.40%) were superior to that of group 1 (mean percentage pain 15%). Therefore, subjectively, on inter-group analysis of the mean Oswestry Low Back Pain and Disability Questionnaires group 3, again, responded the best.

In summary of all the subjective data, although no statistically significant differences could be noted on inter-group analysis, group 3 did show the largest reduction in the mean percentage pain for NPRS and the mean percentage pain and disability for the Oswestry Low Back Pain and Disability Questionnaire. This would suggest that group 3 overall responded superiorly to the use of both the sacroiliac adjustment and the slow dynamic strengthening exercises in their treatment protocol.

Chapter 6: Conclusions and Recommendations

6.1. Conclusion

Chiropractic Manipulative Therapy (CMT) and slow dynamic strengthening exercises are singularly or in combination beneficial to the reduction of pain and ultimately produce an increased in range of motion of forward flexion, on women with post-partum low back pain.

Group 1 was treated using CMT alone, group 2 was treated using slow dynamic strengthening exercises alone and group 3 was treated using a combination of these two treatment protocols.

Although no statistically significant differences on inter-group analysis of Modified Schober's test, Numerical Pain Rating Scale and the Oswestry Lower Back Pain and Disability Questionnaire were noted; group 3 responded with the largest increase in range of motion and the greatest reduction in pain and disability, than both group 1 and group 2. This was discussed in detail in chapter 5.

Although group 1's initial response to treatment was slower than that of group 2's response to treatment; by the sixth visit group 1 had achieved superior results to group 2. It must be noted these results were not statistically significant.

Based on the findings of this study, the most effective treatment protocol for women suffering with post-partum low back pain is an assimilation of both Chiropractic Manipulative Therapy and slow dynamic strengthening exercises; which are designed to help stabilise and strengthen the pelvis.

The combined treatment offers an advantage to patient's suffering from post-partum low back pain. Short-term, relief is achieved through correction of the dysfunctional sacroiliac joint; together with the long-term, rehabilitative relief achieved through the strengthening of the muscles that surround and support the pelvis.

6.2. Recommendations

The following recommendations are made to aid persons in future studies involving the identical condition:

1. A future researcher should increase the sample size of ten people per group to either fifteen or twenty people per group. This would make statistically significant differences and trends more apparent in the results chapter.

2. A future researcher should consider adjusting both the sacroiliac joint and the lumbar spine due to the muscles being strengthened, especially the Psoas muscle, attaching to the lateral aspects of the last thoracic vertebra and all five of the lumbar vertebrae and so correcting all aberrant joint functioning.

3. A possible one month follow-up appointment could be conducted to determine which group had the longer lasting benefits from this study.

4. A future researcher could prescribe a home strengthening and stretching programme so the benefit of the treatment they received during this study could be maintained.

5. Lumbar spine range of motion could be measured in all directions not just forward flexion using a computerised range of motion goniometer to ensure greater reliability and accuracy of the objective measurements.

6. A myofascial component could be utilised such as dry needling of the involved muscles' active trigger points, instead of just strengthening the involved muscles, for superior pain relief and longer lasting beneficial results.

Chapter 7: References

7.1. References

Bolton J.E., Wilkinson R.C. (1998): Responsiveness of Pain Scales: A Comparison of Three Pain Intensity Measures in Chiropractic Patients. *Journal of Manipulative and Physiological Therapeutics.* Vol. 21, No. 1 Pp 1 - 7.

Chapman-Smith D. (1989): Spinal Adjustment – Principles and proven effects. *The Chiropractic Report.* Vol. 3, No. 3 Pp. 2 - 3.

Chapman-Smith D. (1990): Sacroiliac joint dysfunction. *The Chiropractic Report.* Vol. 5, No. 3 Pp. 1 - 2.

Cramer G.D., Darby S.A. (1995): Basic clinical anatomy of the spine, spinal cord and ANS. Mosby. Pp. 222 - 247.

Dirckx J.H. (1997): Stedman's Concise Medical and Allied Health Dictionary. Williams & Wilkins. Pp 443 & 836.

Dishman J.D., Bulbulian R. (2000): Spinal Reflex Attenuation Associated with Spinal Manipulation. *Spine.* Vol. 25, No. 19. Pp 2519 - 2525.

Dreyfuss P., Michaelsen M., Pauza K., McLarty J., Bogduk N. (1996): The Value of Medical History and Physical Examination in Diagnosing Sacroiliac Joint Pain. *Spine.* Vol. 21, No. 22 Pp 2594 - 2602.

Evans R.C. (1990): Illustrated Essentials in Orthopaedic Physical Assessment. Mosby-Year Book Inc. Pp. 326 - 327.

Forrester M. (2003): Low Back Pain in Pregnancy. *Acupuncture in Medicine.* Vol. 21. Pp 36.

Frost H., Klaber Moffett J.A., Moser J.S., Fairbank J.C.T. (1995): Randomised Controlled Trial for Evaluation of Fitness Program for Patients with Chronic Low Back Pain. *British Medical Journal.* Vol. 310, Pp 151.

Gatterman M.L. (1990): Chiropractic management of spine related disorders, Lippincott Williams and Wilkins. Pp. 408.

Gatterman M.L., Cooperstein R., Lantz C., Pearle S.M., Schneider M.J. (2001): Rating Specific Chiropractic Procedures for Common Low Back Conditions. *Journal of Manipulative and Physiological Therapeutics.* Vol. 24. No. 7. Pp 449 - 451.

Haldeman S. (1992): Principles and Practice of Chiropractic. 2nd Edition. Appleton and Lange. Connecticut. Pp. 220.

Haldeman S. (2000): Neurologic Effects of the Adjustment. *Journal of Manipulative and Physiological Therapeutics.* Vol. 23. No.2. Pp 112 - 114.

Journal of the Canadian Chiropractic Association (1997): Articular Adjustments/ Spinal Manipulation. *Canadian Chiropractic Association Position Statement.* Pp 7 - 8.

Jull, G; Janda, V. (1987) Muscles and Motor Control in Low Back Pain in Twomey, LT (ed) Physical therapy for the low back; Clinics in physical therapy. Churchill–Livingston, New York, NY.

Kirkaldy-Willis W.H., Bernard, Jr. T.N. (1999): Managing Low Back Pain. 4th Edition. Churchill Livingston. Pp. 125 & 127

Kristiansson P., Svärdsudd K., von Schoultz B. (1996): Back Pain During Pregnancy. *Spine.* Vol. 21. No. 6. Pp 702 - 705.

Laslett M., Young S.B., Aprill C.N., McDonald B. (2003): Diagnosing Painful Sacroiliac Joints: A Validity Study of a McKenzie Evaluation and Sacroiliac Provocation Tests. *Australian Journal of Physiotherapy.* Vol. 49. Pp 89.

Magnusson M.L., Bishop J.B., Hasselquist L., Spratt K.F., Szpalski M., Pope M.H. (1998): Range of Motion and Motion Patterns in Patients with Low Back Pain Before and After Rehabilitation. *Spine.* Vol. 23. No. 23. Pp 2631 - 2639.

Martini F.H. (1998): Fundamentals of Anatomy and Physiology. 4th Edition. Simon & Schuster / A Viacom Company. Pp 353

Mens J.M.A., Snijders C.J., Stam H.J. (2000): Diagonal Trunk Muscle Exercises in Peripartum Pelvic Pain: A Randomised Clinical Trial. *Physical Therapy.* Vol. 80. No. 12. Pp 1165 - 1168.

Mizel D.H. (1999): Rehabilitation – a valuable consideration in acute and chronic neck and low back pain in addition to standard Chiropractic management: A case study, Journal of Canadian Chiropractic Association.

Moore K.L. (1992): Clinically Orientated Anatomy. 3rd Edition. Williams & Wilkins. Pp 387 & 417.

Netter F.H. (1989): Atlas of Human Anatomy. CIBA-GEIGI. Pp. 149, 335, 457 & 465 - 467.

Pollock M.L., Leggett S.H., Graves J.E., Jones A., Fulton M., Cirulli J. (1989): Effects of Resistance Training on Lumbar Extension Strength. *The American Journal of Sports Medicine.* Vol. 17, No. 5. Pp 624.

Pool-Goudzvaard A.L., Vleeming A., Stoeckart R., Snijders C.J., Mens J.M.A. (1988): Insufficient Lumbopelvic Stability: A Clinical, Anatomical and Biomechanical Approach to “a-specific” Low Back Pain. *Manual Therapy.* Vol. 3. Pp 12 - 20.

Roy S.H., De Luca C.J., Casavant D.A. (1989): Lumbar Muscle Fatigue and Chronic Lower Back Pain. *Spine*. Vol 14. No. 9. Pp 892.

Sandoz R. (1976): Some Physical Mechanisms and Effects of Spinal Adjustments. *Annul Swiss Chiropractic Association.* Vol. 6. Pp 91 - 101.

Shaefer R.C., Faye L.J. (1990): Motion palpation and Chiropractic technic – principles of dynamic Chiropractic. 2nd Edition. The Motion Palpation Institute. California. Pp. 244.

Sihvonen T., Huttunen M., Makkonen M., Airaksinen O. (1998): Functional Changes in Back Muscle Activity Correlate with Pain Intensity and Prediction of Low Back Pain during Pregnancy. *Academy of Physical Medicine and Rehabilitation.* Vol. 79. Pp 1210 - 1212.

Simons D.G., Travell J.G., Simons L.S., (1999): Myofascial Pain and Dysfunction 2nd Edition – The Trigger Point Manual – The Upper Half of the Body. Vol 1. Lippincott, Williams & Wilkins. Pp 22 & 109.

Spring H., Illi U., Kunz H., Rothlin K., Schneider W., Tritschler T. (1991): Stretching and strengthening exercises. Thieme Pp. 54, 70 - 71 & 84

Travell J.G., Simons D.G. (1998): Myofascial Pain and Dysfunction 2nd Edition – The Trigger Point Manual – The Lower Extremities. Vol 2. Lippincott, Williams & Wilkins. Pp 89 - 91, 150 – 152 & 186 - 189.

Vleeming A., Mooney V., Dorman T., Snijders C., Stoeckart R. (1997): Movement, stability and low back pain – The essential role of the pelvis. Churchill Livingston. Pp. 416 - 418.

Waddell G. (1993): Annals of the Rheumatic Diseases. Simple low back pain: rest or active exercise. *Dynamic Chiropractic*. Vol 11. Issue 24. Pp 317 - 319.

Chapter 8: Appendices

8.1. Appendix A

Subject Information and Consent Form.

Dear participant

The purpose of this study is to determine the effectiveness of Chiropractic adjustment and pelvic stabilisation exercises in preventing lower back pain.

You must be between the ages of 18 and 40 and have suffered with mechanical lower back pain for more than 3 months to qualify to participate in this study. You will be divided into one of three groups, each of which will receive a different combination of treatment. You will be required to receive 6 treatments over a period of three weeks on alternative days. The research will be conducted at the TWR Chiropractic day Clinic.
During the duration of this study you will be advised to not take medication or any other form of treatment during the duration of the trial as it may influence the outcome of the study.

Participation in this study is voluntary and you are free to refuse to participate or withdraw from this study at any time.

I have fully explained the procedures and have answered all your questions to the best of my ability.

Date: _____Researcher:_____

I have been fully informed of my rights and as to the procedure of this study. I understand that I may refuse to participate in this study or withdraw my consent at any point. I know that any questions I have regarding this study will be answered.

Date: _____Patient: _____

8.2. Appendix B

Patient Details

Name: _____

I.D. number: _____

Residential Address: _____

_____

_____

_____

Tel number (H): _____

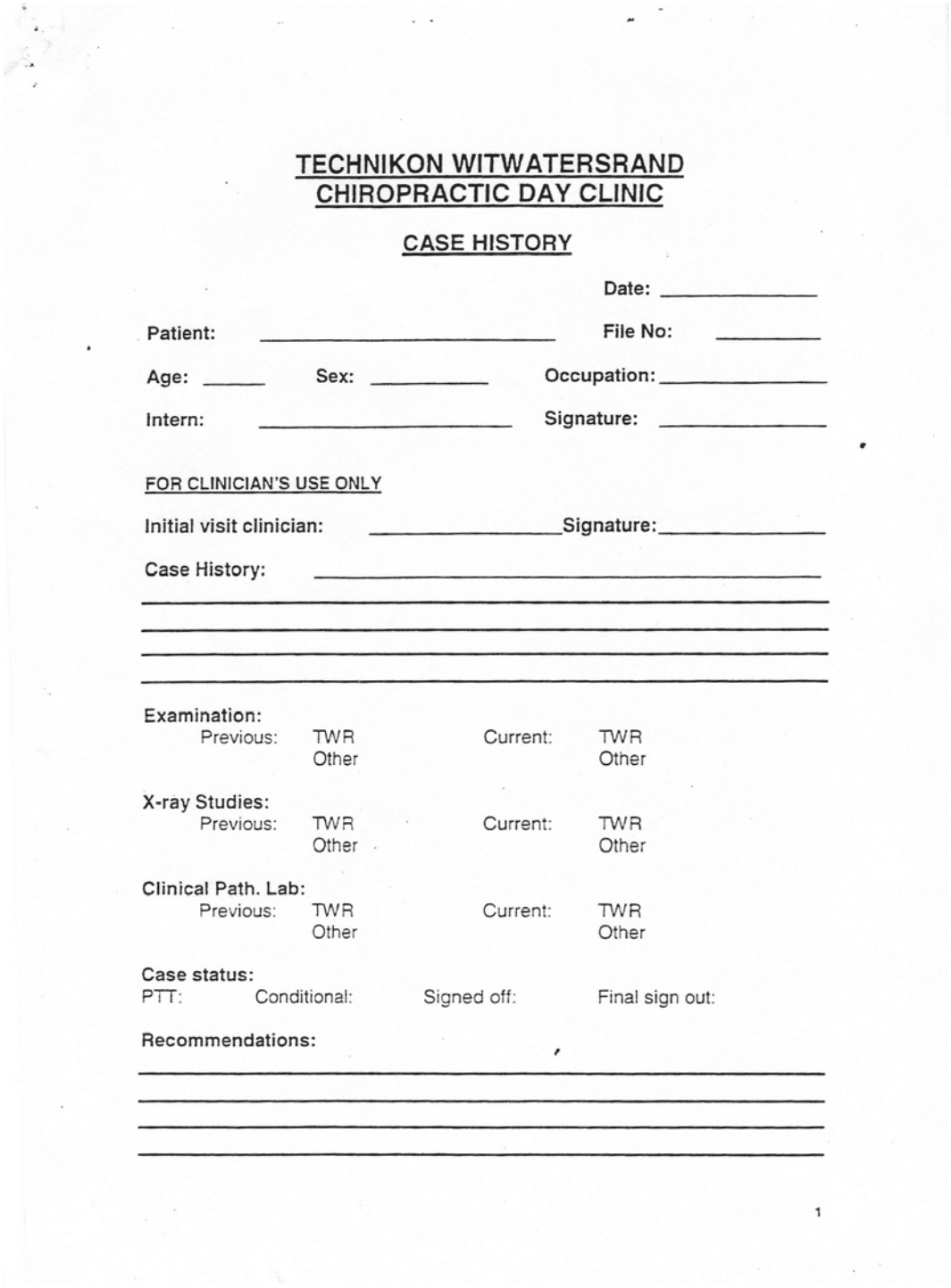
(W): _____

(Cell): _____

Group: _____

Patient number: _____

8.3. Appendix C



TECHNIKON WITWATERSRAND
CHIROPRACTIC DAY CLINIC

CASE HISTORY

Date: _____

Patient: _____ File No: _____

Age: _____ Sex: _____ Occupation: _____

Intern: _____ Signature: _____

FOR CLINICIAN'S USE ONLY

Initial visit clinician: _____ Signature: _____

Case History: _____

_____

_____

_____

_____

Examination:
Previous: TWR Current: TWR
Other Other

X-ray Studies:
Previous: TWR Current: TWR
Other Other

Clinical Path. Lab:
Previous: TWR Current: TWR
Other Other

Case status:
PTT: Conditional: Signed off: Final sign out:

Recommendations:

_____

_____

_____

_____

1

Intern's case history

1. *Source of history:*
2. *Chief complaint: (patient's own words)*

_____
_____
_____
_____
_____

3. *Present illness:*

Location

Onset

Duration

Frequency

Pain (character)

Progression

Aggravating factors

Relieving factors

Associated Sx's and Sg's

Previous occurrences

Past treatment and outcome

4. *Other complaints:*

5. *Past history*

General health status

Childhood illnesses

Adult illnesses

Psychiatric illnesses

Accidents/injuries

Surgery

Hospitalisation

6. *Current health status and lifestyle*

Allergies

Immunizations

Screening tests

Environmental hazards

Safety measures

Exercise and leisure

Sleep patterns

Diet

Current medication

Tobacco

Alcohol

Social drugs

7. *Family history:*
   Immediate family:

Cause of death
DM
Heart disease
TB
HBP
Stroke
Kidney disease
CA
Arthritis
Anaemia
Headaches
Thyroid disease
Epilepsy
Mental illness
Alcoholism
Drug addiction
Other

Psychosocial history:

Home situation

Daily life

Important experiences

Religious beliefs

9. *Review of systems:*

General

Skin

Head

Eyes

Ears

Nose/sinuses

Mouth/throat

Neck

Breasts

Respiratory

Cardiac

Gastro-intestinal

Urinary

Genital

Vascular

Musculoskeletal

Neurologic

Haematologic

Endocrine

Psychiatric

8.4. Appendix D

Pertinent Physical

(Note: This form may only be used when you have completed 35 new patients)

Student Name---------- **Signature**----------
Doctor name ---------- **Signature**----------

Patient Information

Name---------- Occupation----------
Age---------- Sex----------

Vitals:
Height---------- Weight----------

Pulse rate---------- Respiratory rate----------

Blood pressure----------

	Inspection	Palpation	Percussion	Auscultation
Thorax				
Abdomen				

	Inspection	Palpation	Percussion	Auscultaion
	Cranial Nerves	**Motor System**	**Sensory system**	**Cerebellar signs**
Neurologic system				

8.5. Appendix E

TECHNIKON WITWATERSRAND
CHIROPRACTIC DAY CLINIC

REGIONAL EXAMINATION
LUMBAR SPINE AND PELVIS

Date: _____

Patient: _____ **File No:** _____

Clinician: _____ **Signature:** _____

Intern: _____ **Signature:** _____

A. STANDING

1. BODY TYPE
2. POSTURE
3. OBSERVATION: -

- Muscle Tone
- Bony + Soft Tissue Contours
- Skin
- Scars
- Discolouration
- Step deformity

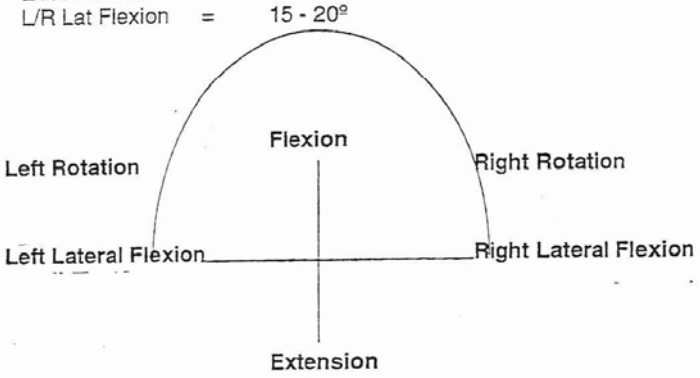
4. SPECIAL TESTS

- Schober's Test
- Spinous Percussion
- Treadmill
- Minor's Sign
- Quick Test
- Tredelenburg Test

1

5. **RANGE OF MOTION**

Forward flexion	=	40 - 60º (15cm from floor)
Extension	=	20 - 35º
L/R Rotation	=	3 - 18º
L/R Lat Flexion	=	15 - 20º



/ = Pain free limitation **// = Painful limitation**

6. **GAIT**

- Rhythm, pendulousness
- On Toes (S1)
- On Heels (L4, 5)
- Halt Squat on one leg (L2, 3, 4)
- Tandem Walking

7. **MOTION PALPATION – sacroiliac joints**

B. **SITTING**

01. SPECIAL TESTS

- Tripod Test
- Kemp's Test
- Valsalva Manoeuvre

2. MOTION PALPATION

Jt. Play			Left					Right				Jt. Play		
P/A	Lat	Fle	Ext	LF	AR	PR		Fle	Ext	LF	AR	PR	P/A	Lat
							T10							
							T11							
							T12							
							L1							
							L2							
							L3							
							L4							
							L5							
					U	L	S1	U	L					

C. SUPINE

01. OBSERVATION

- Hair, Skin, Nails
- Fasciculations

2. PULSES

- Femoral
- Popliteal
- Dorsalis Pedis
- Posterior Tibial

3. MUSCLE CIRCUMFERENCE

	LEFT	RIGHT
THIGH	cm	cm
CALF	cm	cm

4. LEG LENGTH

	LEFT	RIGHT
ACTUAL	cm	cm
APPARENT	cm	cm

5. ABDOMINAL EXAMINATION

- Observation
- Abdominal Reflexes
- Auscultation Abdomen and Groin
- Palpation Abdomen and Groin

Comments: _____

NEUROLOGICAL EXAMINATION

DERMATOMES	Left	Right	MYOTOMES	Left	Right	REFLEXES	Left	Right
T12			Hip Flexion (L1/L2)			Patellar (L3, 4)		
L1			Knee Extension (L2, 3, 4)			Medial Hamstring (L5)		
L2			Knee Flexion (L5/S1)			Lateral Hamstring (S1)		
L3			Hip Int. Rot (L4/L5)			Tibialis Posterior (L4, 5)		
L4			Hip Ext. Rot (L5/S1)			Archilles (S1/S2)		
L5			Hip Adduction (L2, 3, 4)			Plantar Reflex		
S1			Hip Abduction (L4/5)					
S2			Ankle Dorsiflexion (L4/L5)					
S3			Hallux Extension (L5)					
			Ankle Plantar Flexion (S1/S2)					
			Eversion (S1)					
			Inversion (L4)					
			Hip Extension (L5/S1)					

7. SPECIAL TESTS

- SLR
- WLR
- Braggard's
- Bowstring
- Sciatic Notch Pressure
- Sign of the Buttock
- Bilateral SLR
- Patrick Faber
- Gaenslen's Test
- Gapping Test
- "Squish" Test
- Gluteus Maximus Stretch
- Thomas' Test
- Rectus Femoris Contracture Test
- Hip Medial Rotation
- Psoas Test

LATERAL RECUMBENT

- Sacroiliac Compression
- Ober's Test
- Femoral Nerve Stretch Test
- Myotomes:
  - Quadratus Lumborum Strength
  - Gluteus Medius Strength

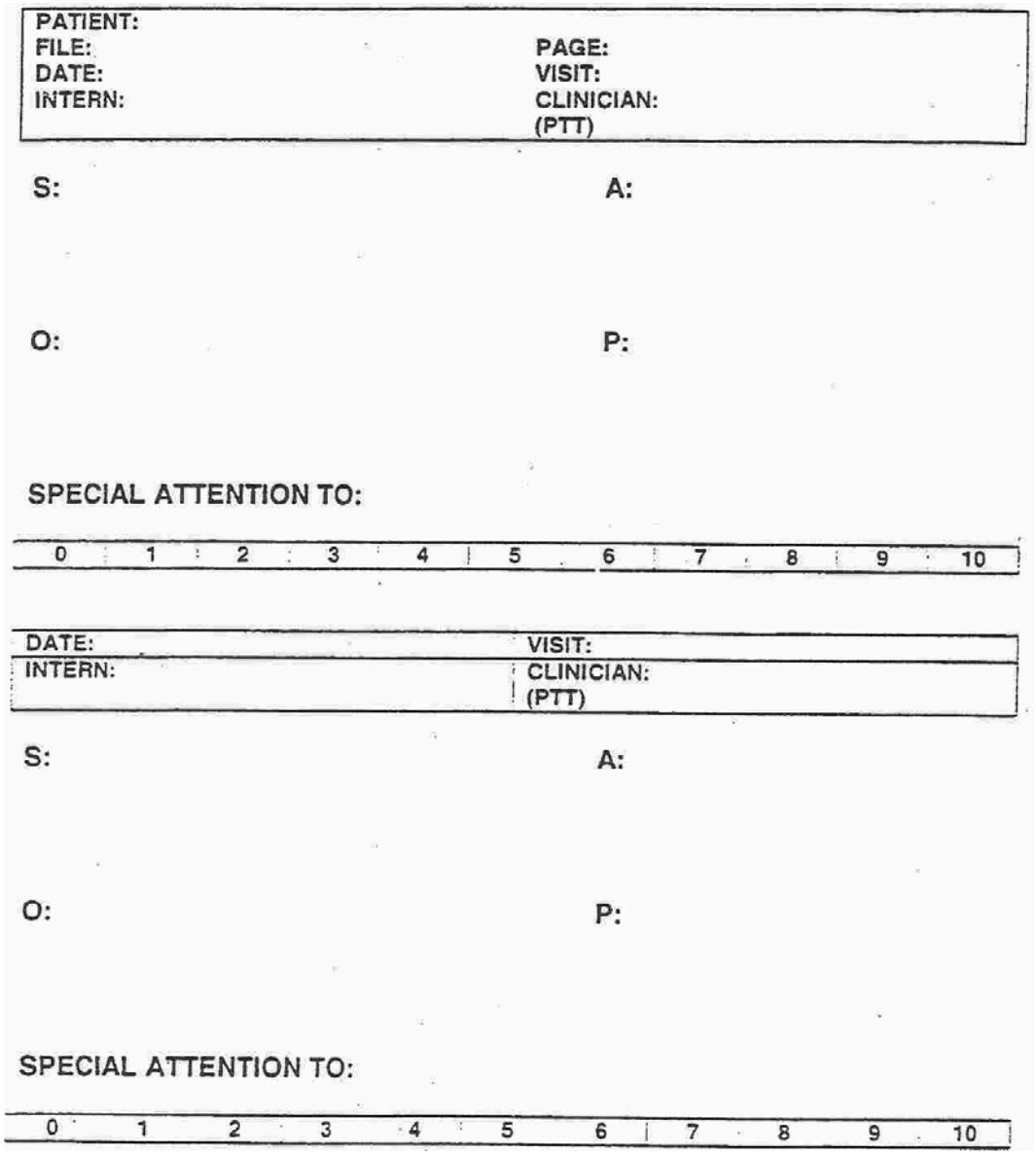
PRONE

- Facet joint challenge
- Myofascial Trigger points:
  - * Quadratus Lumborum
  - * Gluteus Medius
  - * Gluteus Maximus
  - * Piriformis
  - * Tensor Fascia Lata
  - * Hamstrings
- Skin Rolling
- Erichsen's Test
- Sacroiliac Tenderness
- Pheasant's Test
- Gluteal Skyline
- Myotomes:
  - * Gluteus Maximus strength

NON-ORGANIC SIGNS

- Pin-point pain
- Axial Compression
- Trunk Rotation
- Burn's Bench Test
- Flip Test
- Hoover's Test
- Ankle Dorsiflexion Test
- Pin-point pain

8.6. Appendix F



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FILE:
DATE:
INTERN:

PAGE:
VISIT:
CLINICIAN:
(PTT)

S:

A:

O:

P:

SPECIAL ATTENTION TO:

0 1 2 3 4 5 6 7 8 9 10

DATE:

VISIT:

INTERN:

CLINICIAN:
(PTT)

S:

A:

O:

P:

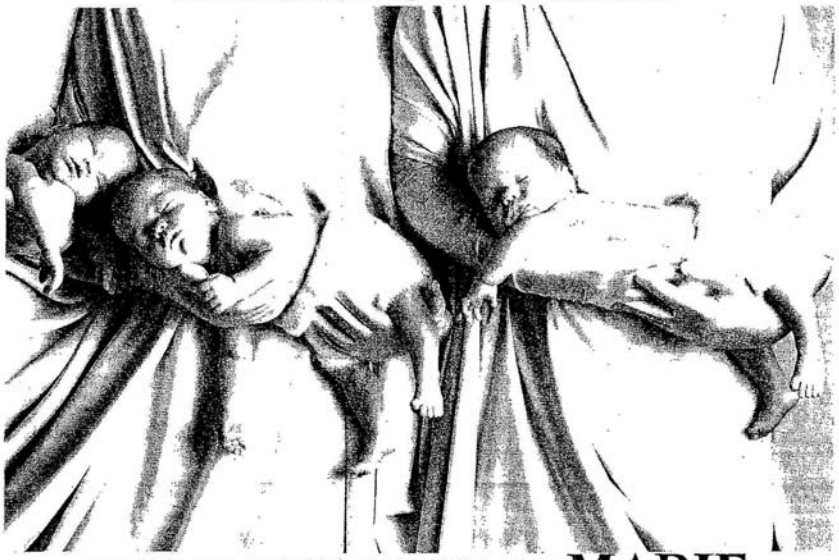
SPECIAL ATTENTION TO:

0 1 2 3 4 5 6 7 8 9 10

8.7. Appendix F

DO YOU SUFFER FROM POST-PARTUM (POST PREGNANCY) LOWER BACK PAIN?

WOULD YOU LIKE TO PARTICIPATE IN A FREE RESEARCH TRIAL?



IF SO PLEASE CONTACT **MARIE THICKITT** ON **082 940 7129**

FOR MORE INFORMATION

MARIE 082 940 7129	MARIE 082 940 7129	MARIE 082 940 7129	MARIE 082 940 7129	MARIE 082 940 7129	MARIE 082 940 7129	MARIE 082 940 7129	MARIE 082 940 7129	MARIE 082 940 7129	MARIE 082 940 7129	MARIE 082 940 7129	MARIE 082 940 7129	MARIE 082 940 7129	MARIE 082 940 7129	MARIE 082 940 7129	MARIE 082 940 7129	MARIE 082 940 7129

8.8. Appendix G

Free

Are you suffering from post-pregnancy lower back pain?

Would you like to participate in a Chiropractic research trial?

Please contact Marie Rosenberg on 082-9407129 for more information.

8.9. Appendix H

Numerical Pain Rating Scale:

Patient Name_____ **Group**_____

Treatment # 1 Date_____

0	1	2	3	4	5	6	7	8	9	10

0=no pain 10=Worst pain ever experienced

Treatment # 3 Date_____

0	1	2	3	4	5	6	7	8	9	10

0=no pain 10=Worst pain ever experienced

Treatment # 6 Date_____

0	1	2	3	4	5	6	7	8	9	10

0=no pain 10=Worst pain ever experienced

8.10. Appendix I

OWESRTY LOW BACK PAIN AND DISABILITY QUESTIONAIRRE

Patient name: _____ **Date:**_____ **File #:** _____

This questionnaire has been designed to give the doctor information as to how your back pain has affected your ability to manage everyday life. Please answer every section and mark in each section only the one box, which applies to you. We realize you may consider that two of the statements in any one section relate to you, but please just mark the box which most closely describes your problem.

SECTION 1-PAIN INTENSITY □The pain is mild and does not vary much. □The pain comes and goes and is moderate. □The pain is moderate and does not vary much. □The pain comes and goes and is severe. □The pain is severe and does not vary much. SECTION 2-PERSONAL CARE □I would not have to change my way of washing or dressing in order to avoid pain. □I do not normally change my way of washing or dressing even though it causes some pain. □Washing and dressing increase the pain but I manage not to change my way of doing it. □Washing and dressing increase the pain and I find it necessary to change my way of doing it. □Because of the pain I am unable to do some washing and dressing without help. □Because of the pain I am unable to do any washing and dressing without help. SECTION 3-LIFTING □I can lift heavy weights without extra pain. □I can lift heavy weights but it causes extra pain. □Pain prevents me from lifting heavy weights off the floor. □Pain prevents me from lifting heavy weights off the floor, but I manage if they are conveniently positioned (e.g. on a table). □Pain prevents me from lifting heavy weights but I can manage light to medium weights if they are conveniently positioned. □I can only lift very light weights at the most. SECTION 4-WALKING □I have no pain on walking. □I have some pain on walking but it does not increase with distance. □I cannot walk more than one km, without increasing pain. □I cannot walk more than half a km, without increasing pain. □I cannot walk more than a quarter of a km, without increasing pain. □I cannot walk at all without increasing pain. SECTION 5-SITTING □I can sit in any chair as long as I like. □I can only sit in my favourite chair as long as I like. □Pain prevents me from sitting more than one hour. □Pain prevents me from sitting more than half an hour. □Pain prevents me from sitting more than ten minutes. □I avoid sitting because it increases pain straight away.	SECTION 6-STANDING □I can stand as long as I want without pain. □I have some pain on standing but it does not increase with time. □I cannot stand for longer than one hour without increasing pain. □I cannot stand for longer than half an hour without increasing pain. □I cannot stand longer than ten minutes without increasing pain. □I avoid standing because it increases pain straight away. SECTION 7-SLEEPING □I get no pain in bed. □I get pain in bed but it does not prevent me from sleeping well. □Because of pain my normal night's sleep is reduced by less than a quarter. □Because of pain my normal night's sleep is reduced by less than half. □Because of pain my normal night's sleep is reduced by less than three quarters. □Pain prevents me from sleeping at all. SECTION 8-SOCIAL LIFE □My social life is normal and gives me no pain. □My social life is normal but increases the degree of pain. □Pain has no significant effect on my social life apart from limiting my more energetic interests, e.g. dancing. □Pain has restricted my social life and I do not go out very often. □Pain has restricted my social life to my home. □I have hardly any social life because of the pain. SECTION 9-TRAVELLING □I get no pain whilst travelling. □I get some pain whilst travelling but none of my usual forms of travel make it any worse. □I get extra pain whilst travelling but it does not compel me to seek alternative forms of travel. □I get extra pain whilst travelling which compels me to seek alternative forms of travel. □Pain restricts all forms of travel. □Pain prevents all forms of travel except that done lying down. SECTION 10-CHANGING DEGREE OF PAIN □My pain is rapidly getting better. □My pain fluctuates but overall is definitely getting better. □My pain seems to be getting better but improvement is slow at present. □My pain is neither getting better nor worse. □My pain is gradually worsening. □My pain is rapidly worsening.

8.11. Appendix J: Testing For Compounding Variables

8.11.1. Tests of Normality

	Kolmogorov-Smirnov(a)			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Age	.187	30	.009	.941	30	.094
Height	.153	30	.071	.960	30	.315
Weight	.208	30	.002	.821	30	.000
Body Mass Index	.198	30	.004	.797	30	.000
Schober's Test Week 1	.205	30	.002	.934	30	.062
Schober's Test Week 3	.187	30	.009	.899	30	.008
Schober's Test Week 6	.223	30	.001	.927	30	.041
Numerical Pain Scale Week 1	.135	30	.168	.944	30	.117
Numerical Pain Scale Week 3	.144	30	.117	.956	30	.237
Numerical Pain Scale Week 6	.250	30	.000	.734	30	.000
Oswestry Pain And Disability Questionnaire Week 1	.127	30	.200(*)	.979	30	.790
Oswestry Pain And Disability Questionnaire Week 3	.102	30	.200(*)	.970	30	.540
Oswestry Pain And Disability Questionnaire Week 6	.251	30	.000	.692	30	.000

* This is a lower bound of the true significance.

a Lilliefors Significance Correction

8.11.2. Descriptive

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Age	**A - Chiro**	10	30.60	7.074	2.237	25.54	35.66	20	41
	B - Exercise	10	34.80	3.584	1.133	32.24	37.36	30	42
	C - Both	10	32.80	4.022	1.272	29.92	35.68	26	37

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
	Total	30	32.73	5.252	.959	30.77	34.69	20	42
Height	**A - Chiro**	10	1.6530	.10296	.03256	1.5793	1.7267	1.50	1.80
	B - Exercise	10	1.6490	.07015	.02218	1.5988	1.6992	1.58	1.76
	C - Both	10	1.6710	.03510	.01110	1.6459	1.6961	1.63	1.73
	Total	30	1.6577	.07276	.01328	1.6305	1.6848	1.50	1.80
Weight	**A - Chiro**	10	69.950	14.7393	4.6610	59.406	80.494	52.0	94.5
	B - Exercise	10	66.900	14.3329	4.5325	56.647	77.153	55.0	105.0
	C - Both	10	61.600	4.9933	1.5790	58.028	65.172	51.0	69.0
	Total	30	66.150	12.2974	2.2452	61.558	70.742	51.0	105.0
Body Mass Index	**A - Chiro**	10	25.6120	4.88207	1.54385	22.1195	29.1044	17.99	35.14
	B - Exercise	10	24.7720	6.20553	1.96236	20.3328	29.2111	20.18	41.53
	C - Both	10	22.0534	1.55132	.49057	20.9437	23.1631	18.73	23.88
	Total	30	24.1458	4.74140	.86566	22.3753	25.9162	17.99	41.53

8.11.3. ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Age	**Between Groups**	88.267	2	44.133	1.675	.206
	Within Groups	711.600	27	26.356		
	Total	799.867	29			
Height	**Between Groups**	.003	2	.001	.246	.784
	Within Groups	.151	27	.006		
	Total	.154	29			
Weight	**Between Groups**	357.050	2	178.525	1.197	.318
	Within Groups	4028.525	27	149.205		
	Total	4385.575	29			
Body Mass Index	**Between Groups**	69.198	2	34.599	1.603	.220
	Within Groups	582.748	27	21.583		
	Total	651.946	29			

8.11.4. Ranks

	Group	N	Mean Rank
Age	**A - Chiro**	10	12.85
	B - Exercise	10	17.80
	C - Both	10	15.85
	Total	30	
Height	**A - Chiro**	10	15.90
	B - Exercise	10	14.35
	C - Both	10	16.25
	Total	30	
Weight	**A - Chiro**	10	17.75
	B - Exercise	10	15.55
	C - Both	10	13.20
	Total	30	
Body Mass Index	**A - Chiro**	10	19.40
	B - Exercise	10	15.60
	C - Both	10	11.50
	Total	30	

8.11.5. Ranks Test Statistics (a, b)

	Chi-Square	df	Asymp. Sig.
Age	1.618	2	.445
Height	.267	2	.875
Weight	1.341	2	.511
Body Mass Index	4.028	2	.133
a Kruskal Wallis Test			
b Grouping Variable: Group			

8.11.6. Group Pregnancy Problems Cross-tabulation

			Pregnancy Problems		Total
			No	Yes	

Group	**A – Chiro**	**Count**	7	3	10
		% within Group	70.0%	30.0%	100.0%
	B - Exercise	**Count**	6	4	10
		% within Group	60.0%	40.0%	100.0%
	C – Both	**Count**	9	1	10
		% within Group	90.0%	10.0%	100.0%
Total		**Count**	22	8	30
		% within Group	73.3%	26.7%	100.0%

8.11.7. Chi-Square Tests

	Value	**df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	2.386(a)	2	.303
Likelihood Ratio	2.616	2	.270
Linear-by-Linear Association	.989	1	.320
N of Valid Cases	30		
a 3 cells (50.0%) have expected count less than 5. The minimum expected count is 2.67.			

8.11.8. Symmetric Measures

		Value	**Approx. Sig.**
Nominal by Nominal	**Phi**	.282	.303
	Cramer's V	.282	.303
	Contingency Coefficient	.271	.303
N of Valid Cases		30	
a Not assuming the null hypothesis.			
b Using the asymptotic standard error assuming the null hypothesis.			

8.12. Appendix K: Basic Descriptive

8.12.1. Group

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	A - Chiro	10	33.3	33.3	33.3
	B - Exercise	10	33.3	33.3	66.7
	C - Both	10	33.3	33.3	100.0
	Total	30	100.0	100.0	

8.12.2. Statistics: Age

N	Valid	30
	Missing	0
Mean		32.73
Median		34.00
Std. Deviation		5.252
Skewness		-.719
Kurtosis		.282

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20	1	3.3	3.3	3.3
	22	1	3.3	3.3	6.7
	25	2	6.7	6.7	13.3
	26	1	3.3	3.3	16.7
	27	1	3.3	3.3	20.0
	29	1	3.3	3.3	23.3
	30	1	3.3	3.3	26.7
	32	2	6.7	6.7	33.3
	33	4	13.3	13.3	46.7
	34	4	13.3	13.3	60.0
	35	4	13.3	13.3	73.3
	36	1	3.3	3.3	76.7
	37	3	10.0	10.0	86.7
	38	2	6.7	6.7	93.3
	41	1	3.3	3.3	96.7
	42	1	3.3	3.3	100.0
	Total	30	100.0	100.0	

Statistics						
	N	Mean	Median	Std. Deviation	Skewness	Kurtosis
	Valid					
Height	30	1.6577	1.6750	.07276	-.457	-.202
Weight	30	66.150	63.500	12.2974	1.765	3.234
Body Mass Index	30	24.1458	23.0054	4.74140	2.165	5.975

8.12.3. Statistics: Height

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	**1.50**	1	3.3	3.3	3.3
	1.51	1	3.3	3.3	6.7
	1.54	1	3.3	3.3	10.0
	1.58	3	10.0	10.0	20.0
	1.59	1	3.3	3.3	23.3
	1.60	1	3.3	3.3	26.7
	1.63	1	3.3	3.3	30.0
	1.64	4	13.3	13.3	43.3
	1.65	1	3.3	3.3	46.7
	1.67	1	3.3	3.3	50.0
	1.68	2	6.7	6.7	56.7
	1.70	6	20.0	20.0	76.7
	1.71	1	3.3	3.3	80.0
	1.72	1	3.3	3.3	83.3
	1.73	3	10.0	10.0	93.3
	1.76	1	3.3	3.3	96.7
	1.80	1	3.3	3.3	100.0
	Total	30	100.0	100.0	

8.12.4. Statistics: Weight

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	**51.0**	1	3.3	3.3	3.3
	52.0	1	3.3	3.3	6.7
	55.0	2	6.7	6.7	13.3
	57.0	1	3.3	3.3	16.7
	58.0	1	3.3	3.3	20.0
	59.0	3	10.0	10.0	30.0

		Frequency	Percent	Valid Percent	Cumulative Percent
	60.0	2	6.7	6.7	36.7
	61.0	1	3.3	3.3	40.0
	62.0	2	6.7	6.7	46.7
	63.0	1	3.3	3.3	50.0
	64.0	3	10.0	10.0	60.0
	65.0	1	3.3	3.3	63.3
	66.0	2	6.7	6.7	70.0
	69.0	3	10.0	10.0	80.0
	72.0	1	3.3	3.3	83.3
	74.0	1	3.3	3.3	86.7
	78.0	1	3.3	3.3	90.0
	92.0	1	3.3	3.3	93.3
	94.5	1	3.3	3.3	96.7
	105.0	1	3.3	3.3	100.0
	Total	30	100.0	100.0	

8.12.5. Statistics: Body Mass Index

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	**17.99**	1	3.3	3.3	3.3
	18.73	1	3.3	3.3	6.7
	20.18	1	3.3	3.3	10.0
	20.28	1	3.3	3.3	13.3
	20.76	1	3.3	3.3	16.7
	20.90	1	3.3	3.3	20.0
	21.38	1	3.3	3.3	23.3
	21.48	1	3.3	3.3	26.7
	21.94	1	3.3	3.3	30.0
	22.05	1	3.3	3.3	33.3
	22.15	1	3.3	3.3	36.7
	22.28	1	3.3	3.3	40.0
	22.84	1	3.3	3.3	43.3
	22.95	1	3.3	3.3	46.7
	22.96	1	3.3	3.3	50.0
	23.05	1	3.3	3.3	53.3
	23.19	1	3.3	3.3	56.7
	23.23	1	3.3	3.3	60.0
	23.42	1	3.3	3.3	63.3

		Frequency	Percent	Valid Percent	Cumulative Percent
	23.88	1	3.3	3.3	66.7
	24.84	1	3.3	3.3	70.0
	24.91	1	3.3	3.3	73.3
	25.33	1	3.3	3.3	76.7
	26.04	1	3.3	3.3	80.0
	26.06	1	3.3	3.3	83.3
	26.22	1	3.3	3.3	86.7
	28.40	1	3.3	3.3	90.0
	30.26	1	3.3	3.3	93.3
	35.14	1	3.3	3.3	96.7
	41.53	1	3.3	3.3	100.0
	Total	30	100.0	100.0	

8.12.6. Gravity – Number of Pregnancies

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	**1**	10	33.3	33.3	33.3
	2	12	40.0	40.0	73.3
	3	5	16.7	16.7	90.0
	4	3	10.0	10.0	100.0
	Total	30	100.0	100.0	

8.12.7. Parity – Number of Births

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	**1**	14	46.7	46.7	46.7
	2	10	33.3	33.3	80.0
	3	5	16.7	16.7	96.7
	4	1	3.3	3.3	100.0
	Total	30	100.0	100.0	

8.12.8. Pregnancy Problems

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	**No**	22	73.3	73.3	73.3
	Yes	8	26.7	26.7	100.0
	Total	30	100.0	100.0	

8.12.9. Statistics: Modified Schober's Test

	N	Mean	Median	Std. Deviation	Skewness	Kurtosis
	Valid					
Schober's Test Week 1	30	4.900	5.000	1.0372	-.310	.923
Schober's Test Week 3	30	5.183	5.500	1.0379	-1.098	1.482
Schober's Test Week 6	30	5.783	6.000	.9531	-.894	1.447

8.12.10. Schober's Test Week 1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	**2.5**	1	3.3	3.3	3.3
	3.0	2	6.7	6.7	10.0
	3.5	1	3.3	3.3	13.3
	4.0	3	10.0	10.0	23.3
	4.5	3	10.0	10.0	33.3
	5.0	8	26.7	26.7	60.0
	5.5	8	26.7	26.7	86.7
	6.0	3	10.0	10.0	96.7
	7.5	1	3.3	3.3	100.0
	Total	30	100.0	100.0	

8.12.11. Schober's Test Week 3

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	**2.0**	1	3.3	3.3	3.3
	3.5	1	3.3	3.3	6.7
	4.0	4	13.3	13.3	20.0
	4.5	3	10.0	10.0	30.0
	5.0	4	13.3	13.3	43.3
	5.5	6	20.0	20.0	63.3
	6.0	8	26.7	26.7	90.0
	6.5	3	10.0	10.0	100.0
	Total	30	100.0	100.0	

8.12.12. Schober's Test Week 6

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	**3.0**	1	3.3	3.3	3.3

		Frequency	Percent	Valid Percent	Cumulative Percent
	4.0	1	3.3	3.3	6.7
	4.5	2	6.7	6.7	13.3
	5.0	3	10.0	10.0	23.3
	5.5	4	13.3	13.3	36.7
	6.0	11	36.7	36.7	73.3
	6.5	4	13.3	13.3	86.7
	7.0	3	10.0	10.0	96.7
	7.5	1	3.3	3.3	100.0
	Total	30	100.0	100.0	

8.12.13. Statistics: Numerical Pain Rating Scale

	N	Mean	Median	Std. Deviation	Skewness	Kurtosis
	Valid					
Numerical Pain Scale Week 1	30	47.67	50.00	14.368	-.327	.206
Numerical Pain Scale Week 3	30	37.50	35.00	20.374	.382	.235
Numerical Pain Scale Week 6	30	16.83	10.00	23.062	1.736	2.334

8.12.14. Numerical Pain Rating Scale Week 1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	**10**	1	3.3	3.3	3.3
	30	4	13.3	13.3	16.7
	35	1	3.3	3.3	20.0
	40	6	20.0	20.0	40.0
	45	1	3.3	3.3	43.3
	50	8	26.7	26.7	70.0
	60	5	16.7	16.7	86.7
	70	4	13.3	13.3	100.0
	Total	30	100.0	100.0	

8.12.15. Numerical Pain Rating Scale Week 3

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	**0**	2	6.7	6.7	6.7
	20	7	23.3	23.3	30.0
	25	1	3.3	3.3	33.3
	30	5	16.7	16.7	50.0

		Frequency	Percent	Valid Percent	Cumulative Percent
	40	4	13.3	13.3	63.3
	50	5	16.7	16.7	80.0
	60	4	13.3	13.3	93.3
	70	1	3.3	3.3	96.7
	90	1	3.3	3.3	100.0
	Total	30	100.0	100.0	

8.12.16. Numerical Pain Rating Scale Week 6

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	**0**	12	40.0	40.0	40.0
	10	7	23.3	23.3	63.3
	15	1	3.3	3.3	66.7
	20	4	13.3	13.3	80.0
	30	1	3.3	3.3	83.3
	40	1	3.3	3.3	86.7
	50	1	3.3	3.3	90.0
	60	1	3.3	3.3	93.3
	80	2	6.7	6.7	100.0
	Total	30	100.0	100.0	

8.12.17. Statistics: Oswestry Pain and Disability Questionnaire

	N	Mean	Median	Std. Deviation	Skewness	Kurtosis
	Valid					
Oswestry Pain And Disability Questionnaire Week 1	30	27.20	27.00	10.394	.308	-.253
Oswestry Pain And Disability Questionnaire Week 3	30	23.13	23.00	13.429	.419	-.476
Oswestry Pain And Disability Questionnaire Week 6	30	13.60	7.00	17.240	2.662	9.067

8.12.18. Oswestry Pain and Disability Questionnaire Week 1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	**8**	1	3.3	3.3	3.3
	12	2	6.7	6.7	10.0
	14	1	3.3	3.3	13.3
	18	3	10.0	10.0	23.3
	20	2	6.7	6.7	30.0

		Frequency	Percent	Valid Percent	Cumulative Percent
	22	2	6.7	6.7	36.7
	24	1	3.3	3.3	40.0
	26	3	10.0	10.0	50.0
	28	2	6.7	6.7	56.7
	30	5	16.7	16.7	73.3
	34	2	6.7	6.7	80.0
	36	1	3.3	3.3	83.3
	38	1	3.3	3.3	86.7
	42	1	3.3	3.3	90.0
	44	1	3.3	3.3	93.3
	46	1	3.3	3.3	96.7
	50	1	3.3	3.3	100.0
	Total	30	100.0	100.0	

8.12.19. Oswestry Pain and Disability Questionnaire Week 3

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	**2**	1	3.3	3.3	3.3
	4	1	3.3	3.3	6.7
	6	2	6.7	6.7	13.3
	8	1	3.3	3.3	16.7
	10	1	3.3	3.3	20.0
	12	1	3.3	3.3	23.3
	14	3	10.0	10.0	33.3
	16	2	6.7	6.7	40.0
	20	2	6.7	6.7	46.7
	22	1	3.3	3.3	50.0
	24	3	10.0	10.0	60.0
	26	1	3.3	3.3	63.3
	28	1	3.3	3.3	66.7
	30	3	10.0	10.0	76.7
	34	1	3.3	3.3	80.0
	36	1	3.3	3.3	83.3
	40	1	3.3	3.3	86.7
	42	2	6.7	6.7	93.3
	46	1	3.3	3.3	96.7
	54	1	3.3	3.3	100.0
	Total	30	100.0	100.0	

8.12.20. Oswestry Pain and Disability Questionnaire Week 6

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	**2**	11	36.7	36.7	36.7
	4	2	6.7	6.7	43.3
	6	2	6.7	6.7	50.0
	8	2	6.7	6.7	56.7
	12	1	3.3	3.3	60.0
	14	3	10.0	10.0	70.0
	18	1	3.3	3.3	73.3
	20	1	3.3	3.3	76.7
	22	1	3.3	3.3	80.0
	24	2	6.7	6.7	86.7
	28	1	3.3	3.3	90.0
	32	1	3.3	3.3	93.3
	44	1	3.3	3.3	96.7
	84	1	3.3	3.3	100.0
	Total	30	100.0	100.0	

8.13. Appendix L: Testing Between Groups (Differences)

8.13.1. Descriptive

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Difference (3-1) Schober's Test 1	**A - Chiro**	10	-.55	1.423	.450	-1.57	.47	-4	1
	B - Exercise	10	.35	.242	.076	.18	.52	0	1
	C - Both	10	1.05	.896	.283	.41	1.69	0	3
	Total	30	.28	1.157	.211	-.15	.72	-4	3
Difference (6-3) Schober's Test 2	**A - Chiro**	10	.90	1.663	.526	-.29	2.09	-2	5
	B - Exercise	10	.30	.350	.111	.05	.55	0	1
	C - Both	10	.60	.775	.245	.05	1.15	-1	2
	Total	30	.60	1.070	.195	.20	1.00	-2	5
Difference (3-1) Numerical Pain Scale 1	**A - Chiro**	10	-5.00	28.771	9.098	-25.58	15.58	-30	50
	B - Exercise	10	-11.00	19.692	6.227	-25.09	3.09	-50	20
	C - Both	10	-14.50	10.916	3.452	-22.31	-6.69	-30	0
	Total	30	-10.17	20.740	3.787	-17.91	-2.42	-50	50
Difference (6-3) Numerical Pain Scale 2	**A - Chiro**	10	-28.00	19.322	6.110	-41.82	-14.18	-60	10
	B - Exercise	10	-16.00	10.750	3.399	-23.69	-8.31	-30	0
	C - Both	10	-18.00	11.353	3.590	-26.12	-9.88	-30	0
	Total	30	-20.67	14.840	2.709	-26.21	-15.13	-60	10
Difference (3-1) Oswestry Pain And Disability 1	**A - Chiro**	10	-1.60	7.043	2.227	-6.64	3.44	-16	8
	B - Exercise	10	-4.00	8.844	2.797	-10.33	2.33	-22	10
	C - Both	10	-6.60	9.477	2.997	-13.38	.18	-22	6
	Total	30	-4.07	8.477	1.548	-7.23	-.90	-22	10
Difference (6-3) Oswestry Pain And Disability 2	**A - Chiro**	10	-8.20	15.010	4.746	-18.94	2.54	-28	30
	B - Exercise	10	-10.60	10.627	3.361	-18.20	-3.00	-38	0
	C - Both	10	-9.80	5.922	1.873	-14.04	-5.56	-18	-2
	Total	30	-9.53	10.811	1.974	-13.57	-5.50	-38	30

8.13.2. Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Sig.
Difference (3-1) Schober's Test 1	7.896	2	27	.002
Difference (6-3) Schober's Test 2	1.970	2	27	.159
Difference (3-1) Numerical Pain Scale 1	4.538	2	27	.020
Difference (6-3) Numerical Pain Scale 2	1.457	2	27	.251
Difference (3-1) Oswestry Pain And Disability 1	.682	2	27	.514
Difference (6-3) Oswestry Pain And Disability 2	.564	2	27	.575

8.13.3. ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Difference (3-1) Schober's Test 1	**Between Groups**	12.867	2	6.433	6.687	.004
	Within Groups	25.975	27	.962		
	Total	38.842	29			
Difference (6-3) Schober's Test 2	**Between Groups**	1.800	2	.900	.774	.471
	Within Groups	31.400	27	1.163		
	Total	33.200	29			
Difference (3-1) Numerical Pain Scale 1	**Between Groups**	461.667	2	230.833	.519	.601
	Within Groups	12012.500	27	444.907		
	Total	12474.167	29			
Difference (6-3) Numerical Pain Scale 2	**Between Groups**	826.667	2	413.333	2.007	.154
	Within Groups	5560.000	27	205.926		
	Total	6386.667	29			
Difference (3-1) Oswestry Pain And Disability 1	**Between Groups**	125.067	2	62.533	.862	.434
	Within Groups	1958.800	27	72.548		
	Total	2083.867	29			
Difference (6-3) Oswestry Pain And Disability 2	**Between Groups**	29.867	2	14.933	.120	.887
	Within Groups	3359.600	27	124.430		
	Total	3389.467	29			

8.13.4. Multiple Comparisons

Dependent Variable		(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
Difference (3-1) Schober's Test 1	Dunnett T3	A - Chiro	B - Exercise	-.900	.456	.204	-2.20	.40
			C - Both	-1.600(*)	.532	.025	-3.02	-.18
		B - Exercise	A - Chiro	.900	.456	.204	-.40	2.20
			C - Both	-.700	.293	.103	-1.53	.13
		C - Both	A - Chiro	1.600(*)	.532	.025	.18	3.02
			B - Exercise	.700	.293	.103	-.13	1.53
* The mean difference is significant at the .05 level.								

8.13.5. Ranks

	Group	N	Mean Rank
Difference (3-1) Schober's Test 1	A - Chiro	10	10.35
	B - Exercise	10	14.65
	C - Both	10	21.50
	Total	30	
Difference (6-3) Schober's Test 2	A - Chiro	10	17.30
	B - Exercise	10	12.00
	C - Both	10	17.20
	Total	30	
Difference (3-1) Numerical Pain Scale 1	A - Chiro	10	15.90
	B - Exercise	10	16.35
	C - Both	10	14.25
	Total	30	
Difference (6-3) Numerical Pain Scale 2	A - Chiro	10	11.25
	B - Exercise	10	18.40
	C - Both	10	16.85
	Total	30	
Difference (3-1) Oswestry Pain And Disability 1	A - Chiro	10	18.30
	B - Exercise	10	15.00
	C - Both	10	13.20
	Total	30	
Difference (6-3) Oswestry Pain And Disability 2	A - Chiro	10	14.75
	B - Exercise	10	16.80
	C - Both	10	14.95

	Group	N	Mean Rank
	Total	30	

8.13.6. Test Statistics (a, b)

	Chi-Square	df	Asymp. Sig.
Difference (3-1) Schober's Test 1	8.850	2	.012
Difference (6-3) Schober's Test 2	2.520	2	.284
Difference (3-1) Numerical Pain Scale 1	.326	2	.849
Difference (6-3) Numerical Pain Scale 2	3.861	2	.145
Difference (3-1) Oswestry Pain And Disability 1	1.739	2	.419
Difference (6-3) Oswestry Pain And Disability 2	.335	2	.846
a Kruskal Wallis Test			
b Grouping Variable: Group			

8.14. Appendix M: Basic Descriptive

8.14.1. Descriptive

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Schober's Test Week 1	**A - Chiro**	10	5.350	.8515	.2693	4.741	5.959	4.5	7.5
	B - Exercise	10	5.200	.7528	.2380	4.661	5.739	4.0	6.0
	C - Both	10	4.150	1.1068	.3500	3.358	4.942	2.5	5.5
	Total	30	4.900	1.0372	.1894	4.513	5.287	2.5	7.5
Schober's Test Week 3	**A - Chiro**	10	4.800	1.2293	.3887	3.921	5.679	2.0	6.0
	B - Exercise	10	5.550	.7246	.2291	5.032	6.068	4.5	6.5
	C - Both	10	5.200	1.0593	.3350	4.442	5.958	3.5	6.5
	Total	30	5.183	1.0379	.1895	4.796	5.571	2.0	6.5
Schober's Test Week 6	**A - Chiro**	10	5.700	1.1106	.3512	4.906	6.494	3.0	7.0
	B - Exercise	10	5.850	.9144	.2892	5.196	6.504	4.5	7.0
	C - Both	10	5.800	.9189	.2906	5.143	6.457	4.0	7.5
	Total	30	5.783	.9531	.1740	5.427	6.139	3.0	7.5
Numerical Pain Scale Week 1	**A - Chiro**	10	46.00	17.127	5.416	33.75	58.25	10	70
	B - Exercise	10	52.00	11.353	3.590	43.88	60.12	30	70
	C - Both	10	45.00	14.530	4.595	34.61	55.39	30	70
	Total	30	47.67	14.368	2.623	42.30	53.03	10	70
Numerical Pain Scale Week 3	**A - Chiro**	10	41.00	17.920	5.667	28.18	53.82	20	70
	B - Exercise	10	41.00	25.144	7.951	23.01	58.99	0	90
	C - Both	10	30.50	17.393	5.500	18.06	42.94	0	60
	Total	30	37.50	20.374	3.720	29.89	45.11	0	90
Numerical Pain Scale Week 6	**A - Chiro**	10	13.00	24.518	7.753	-4.54	30.54	0	80
	B - Exercise	10	25.00	25.495	8.062	6.76	43.24	0	80
	C - Both	10	12.50	18.745	5.928	-.91	25.91	0	60
	Total	30	16.83	23.062	4.211	8.22	25.44	0	80

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Oswestry Pain And Disability Questionnaire Week 1	A - Chiro	10	24.80	9.390	2.969	18.08	31.52	12	46
	B - Exercise	10	28.00	12.111	3.830	19.34	36.66	8	44
	C - Both	10	28.80	10.163	3.214	21.53	36.07	14	50
	Total	30	27.20	10.394	1.898	23.32	31.08	8	50
Oswestry Pain And Disability Questionnaire Week 3	A - Chiro	10	23.20	14.117	4.464	13.10	33.30	6	54
	B - Exercise	10	24.00	13.166	4.163	14.58	33.42	2	42
	C - Both	10	22.20	14.374	4.546	11.92	32.48	4	46
	Total	30	23.13	13.429	2.452	18.12	28.15	2	54
Oswestry Pain And Disability Questionnaire Week 6	A - Chiro	10	15.00	25.162	7.957	-3.00	33.00	2	84
	B - Exercise	10	13.40	11.433	3.615	5.22	21.58	2	32
	C - Both	10	12.40	13.786	4.359	2.54	22.26	2	44
	Total	30	13.60	17.240	3.148	7.16	20.04	2	84

8.14.2. Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Sig.
Schober's Test Week 1	1.832	2	27	.179
Schober's Test Week 3	1.409	2	27	.262
Schober's Test Week 6	.087	2	27	.917
Numerical Pain Scale Week 1	.616	2	27	.548
Numerical Pain Scale Week 3	.588	2	27	.562
Numerical Pain Scale Week 6	.545	2	27	.586
Oswestry Pain And Disability Questionnaire Week 1	.530	2	27	.594
Oswestry Pain And Disability Questionnaire Week 3	.106	2	27	.899
Oswestry Pain And Disability Questionnaire Week 6	.532	2	27	.594

8.14.3. ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Schober's Test Week 1	Between Groups	8.550	2	4.275	5.096	.013

		Sum of Squares	df	Mean Square	F	Sig.
	Within Groups	22.650	27	.839		
	Total	31.200	29			
Schober's Test Week 3	**Between Groups**	2.817	2	1.408	1.338	.279
	Within Groups	28.425	27	1.053		
	Total	31.242	29			
Schober's Test Week 6	**Between Groups**	.117	2	.058	.060	.942
	Within Groups	26.225	27	.971		
	Total	26.342	29			
Numerical Pain Scale Week 1	**Between Groups**	286.667	2	143.333	.679	.516
	Within Groups	5700.000	27	211.111		
	Total	5986.667	29			
Numerical Pain Scale Week 3	**Between Groups**	735.000	2	367.500	.878	.427
	Within Groups	11302.500	27	418.611		
	Total	12037.500	29			
Numerical Pain Scale Week 6	**Between Groups**	1001.667	2	500.833	.938	.404
	Within Groups	14422.500	27	534.167		
	Total	15424.167	29			
Oswestry Pain And Disability Questionnaire Week 1	**Between Groups**	89.600	2	44.800	.397	.676
	Within Groups	3043.200	27	112.711		
	Total	3132.800	29			
Oswestry Pain And Disability Questionnaire Week 3	**Between Groups**	16.267	2	8.133	.042	.959
	Within Groups	5213.200	27	193.081		
	Total	5229.467	29			
Oswestry Pain And Disability Questionnaire Week 6	**Between Groups**	34.400	2	17.200	.054	.947
	Within Groups	8584.800	27	317.956		
	Total	8619.200	29			

8.14.4. Multiple Comparisons

Dependent Variable		(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
Schober's Test Week 1	Scheffe	A - Chiro	B - Exercise	.1500	.4096	.935	-.911	1.211
			C - Both	1.2000(*)	.4096	.024	.139	2.261
		B - Exercise	A - Chiro	-.1500	.4096	.935	-1.211	.911
			C - Both	1.0500	.4096	.053	-.011	2.111
		C - Both	A - Chiro	-1.2000(*)	.4096	.024	-2.261	-.139
			B - Exercise	-1.0500	.4096	.053	-2.111	.011
* The mean difference is significant at the .05 level.								

8.14.5. Schober's Test Week 1

	Group	N	Subset for alpha = .05	
			1	2
Scheffe(a)	C - Both	10	4.150	
	B - Exercise	10	5.200	5.200
	A - Chiro	10		5.350
	Sig.		.053	.935
Means for groups in homogeneous subsets are displayed.				
a Uses Harmonic Mean Sample Size = 10.000.				

8.14.6. Ranks

	Group	N	Mean Rank
Schober's Test Week 1	A - Chiro	10	18.15
	B - Exercise	10	18.45
	C - Both	10	9.90
	Total	30	
Schober's Test Week 3	A - Chiro	10	12.60
	B - Exercise	10	18.20
	C - Both	10	15.70
	Total	30	
Schober's Test Week 6	A - Chiro	10	15.40
	B - Exercise	10	16.15
	C - Both	10	14.95
	Total	30	

	Group	N	Mean Rank
Numerical Pain Scale Week 1	**A - Chiro**	10	15.25
	B - Exercise	10	18.35
	C - Both	10	12.90
	Total	30	
Numerical Pain Scale Week 3	**A - Chiro**	10	17.25
	B - Exercise	10	16.65
	C - Both	10	12.60
	Total	30	
Numerical Pain Scale Week 6	**A - Chiro**	10	13.25
	B - Exercise	10	19.10
	C - Both	10	14.15
	Total	30	
Oswestry Pain And Disability Questionnaire Week 1	**A - Chiro**	10	13.05
	B - Exercise	10	16.70
	C - Both	10	16.75
	Total	30	
Oswestry Pain And Disability Questionnaire Week 3	**A - Chiro**	10	15.45
	B - Exercise	10	16.20
	C - Both	10	14.85
	Total	30	
Oswestry Pain And Disability Questionnaire Week 6	**A - Chiro**	10	14.30
	B - Exercise	10	17.55
	C - Both	10	14.65
	Total	30	

8.14.7. Test Statistics (a, b)

	Chi-Square	df	Asymp. Sig.
Schober's Test Week 1	6.330	2	.042
Schober's Test Week 3	2.100	2	.350
Schober's Test Week 6	.100	2	.951
Numerical Pain Scale Week 1	1.999	2	.368
Numerical Pain Scale Week 3	1.695	2	.428
Numerical Pain Scale Week 6	2.779	2	.249
Oswestry Pain And Disability Questionnaire Week 1	1.171	2	.557
Oswestry Pain And Disability Questionnaire Week 3	.118	2	.942
Oswestry Pain And Disability Questionnaire Week 6	.865	2	.649
a Kruskal Wallis Test			
b Grouping Variable: Group			

8.15. Appendix N: Testing Within Groups

8.15.1. Group A – Chiropractic

8.15.1.1. Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Schober's Test Week 1	5.350	10	.8515	.2693
	Schober's Test Week 3	4.800	10	1.2293	.3887
Pair 2	Schober's Test Week 1	5.350	10	.8515	.2693
	Schober's Test Week 6	5.700	10	1.1106	.3512
Pair 3	Schober's Test Week 3	4.800	10	1.2293	.3887
	Schober's Test Week 6	5.700	10	1.1106	.3512
Pair 4	Numerical Pain Scale Week 1	46.00	10	17.127	5.416
	Numerical Pain Scale Week 3	41.00	10	17.920	5.667
Pair 5	Numerical Pain Scale Week 1	46.00	10	17.127	5.416
	Numerical Pain Scale Week 6	13.00	10	24.518	7.753
Pair 6	Numerical Pain Scale Week 3	41.00	10	17.920	5.667
	Numerical Pain Scale Week 6	13.00	10	24.518	7.753
Pair 7	Oswestry Pain And Disability Questionnaire Week 1	24.80	10	9.390	2.969
	Oswestry Pain And Disability Questionnaire Week 3	23.20	10	14.117	4.464
Pair 8	Oswestry Pain And Disability Questionnaire Week 1	24.80	10	9.390	2.969
	Oswestry Pain And Disability Questionnaire Week 6	15.00	10	25.162	7.957
Pair 9	Oswestry Pain And Disability Questionnaire Week 3	23.20	10	14.117	4.464
	Oswestry Pain And Disability Questionnaire Week 6	15.00	10	25.162	7.957

8.15.1.2. Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Schober's Test Week 1 & Schober's Test Week 3	10	.101	.782
Pair 2	Schober's Test Week 1 & Schober's Test Week 6	10	.447	.196
Pair 3	Schober's Test Week 3 & Schober's Test Week 6	10	-.008	.982

		N	Correlation	Sig.
Pair 4	**Numerical Pain Scale Week 1 & Numerical Pain Scale Week 3**	10	-.348	.325
Pair 5	**Numerical Pain Scale Week 1 & Numerical Pain Scale Week 6**	10	-.153	.672
Pair 6	**Numerical Pain Scale Week 3 & Numerical Pain Scale Week 6**	10	.625	.054
Pair 7	**Oswestry Pain And Disability Questionnaire Week 1 & Oswestry Pain And Disability Questionnaire Week 3**	10	.897	.000
Pair 8	**Oswestry Pain And Disability Questionnaire Week 1 & Oswestry Pain And Disability Questionnaire Week 6**	10	.895	.000
Pair 9	**Oswestry Pain And Disability Questionnaire Week 3 & Oswestry Pain And Disability Questionnaire Week 6**	10	.855	.002

8.15.1.3. Paired Samples Tests

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	**Schober's Test Week 1 - Schober's Test Week 3**	.5500	1.4230	.4500	-.4680	1.5680	1.222	9	.253
Pair 2	**Schober's Test Week 1 - Schober's Test Week 6**	-.3500	1.0554	.3337	-1.1050	.4050	-1.049	9	.322
Pair 3	**Schober's Test Week 3 - Schober's Test Week 6**	-.9000	1.6633	.5260	-2.0899	.2899	-1.711	9	.121
Pair 4	**Numerical Pain Scale Week 1 - Numerical Pain Scale Week 3**	5.000	28.771	9.098	-15.582	25.582	.550	9	.596
Pair 5	**Numerical Pain Scale Week 1 - Numerical Pain Scale Week 6**	33.000	31.990	10.116	10.116	55.884	3.262	9	.010
Pair 6	**Numerical Pain Scale Week 3 - Numerical Pain Scale Week 6**	28.000	19.322	6.110	14.178	41.822	4.583	9	.001
Pair 7	**Oswestry Pain And Disability Questionnaire Week 1 - Oswestry Pain And Disability Questionnaire Week 3**	1.600	7.043	2.227	-3.438	6.638	.718	9	.491
Pair 8	**Oswestry Pain And Disability Questionnaire Week 1 - Oswestry Pain**	9.800	17.268	5.461	-2.553	22.153	1.795	9	.106

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
	And Disability Questionnaire Week 6								
Pair 9	Oswestry Pain And Disability Questionnaire Week 3 - Oswestry Pain And Disability Questionnaire Week 6	8.200	15.010	4.746	-2.537	18.937	1.728	9	.118

8.15.1.4. Ranks

		N	Mean Rank	Sum of Ranks
Schober's Test Week 3 - Schober's Test Week 1	Negative Ranks	4(a)	6.38	25.50
	Positive Ranks	4(b)	2.63	10.50
	Ties	2(c)		
	Total	10		
Schober's Test Week 6 - Schober's Test Week 1	Negative Ranks	2	4.00	8.00
	Positive Ranks	5	4.00	20.00
	Ties	3		
	Total	10		
Schober's Test Week 6 - Schober's Test Week 3	Negative Ranks	1	6.50	6.50
	Positive Ranks	7	4.21	29.50
	Ties	2		
	Total	10		
Numerical Pain Scale Week 3 - Numerical Pain Scale Week 1	Negative Ranks	6	5.67	34.00
	Positive Ranks	4	5.25	21.00
	Ties	0		
	Total	10		
Numerical Pain Scale Week 6 - Numerical Pain Scale Week 1	Negative Ranks	9	5.50	49.50
	Positive	1	5.50	5.50

		N	Mean Rank	Sum of Ranks
	Ranks			
	Ties	0		
	Total	10		
Numerical Pain Scale Week 6 - Numerical Pain Scale Week 3	**Negative Ranks**	9	5.94	53.50
	Positive Ranks	1	1.50	1.50
	Ties	0		
	Total	10		
Oswestry Pain And Disability Questionnaire Week 3 - Oswestry Pain And Disability Questionnaire Week 1	**Negative Ranks**	5	4.40	22.00
	Positive Ranks	3	4.67	14.00
	Ties	2		
	Total	10		
Oswestry Pain And Disability Questionnaire Week 6 - Oswestry Pain And Disability Questionnaire Week 1	**Negative Ranks**	9	5.00	45.00
	Positive Ranks	1	10.00	10.00
	Ties	0		
	Total	10		
Oswestry Pain And Disability Questionnaire Week 6 - Oswestry Pain And Disability Questionnaire Week 3	**Negative Ranks**	9	5.00	45.00
	Positive Ranks	1	10.00	10.00
	Ties	0		
	Total	10		
a Schober's Test Week 3 < Schober's Test Week 1				
b Schober's Test Week 3 > Schober's Test Week 1				
c Schober's Test Week 3 = Schober's Test Week 1				

8.15.1.5. Test Statistics(c)

	Z	Asymp. Sig. (2-tailed)
Schober's Test Week 3 - Schober's Test Week 1	-1.057(a)	.291
Schober's Test Week 6 - Schober's Test Week 1	-1.035(b)	.301
Schober's Test Week 6 - Schober's Test Week 3	-1.622(b)	.105
Numerical Pain Scale Week 3 - Numerical Pain Scale Week 1	-.673(a)	.501
Numerical Pain Scale Week 6 - Numerical Pain Scale Week 1	-2.247(a)	.025

	Z	Asymp. Sig. (2-tailed)
Numerical Pain Scale Week 6 - Numerical Pain Scale Week 3	-2.662(a)	.008
Oswestry Pain And Disability Questionnaire Week 3 - Oswestry Pain And Disability Questionnaire Week 1	-.564(a)	.573
Oswestry Pain And Disability Questionnaire Week 6 - Oswestry Pain And Disability Questionnaire Week 1	-1.790(a)	.074
Oswestry Pain And Disability Questionnaire Week 6 - Oswestry Pain And Disability Questionnaire Week 3	-1.795(a)	.073
a Based on positive ranks.		
b Based on negative ranks.		
c Wilcoxon Signed Ranks Test		

8.15.2. Group B - Exercise

8.15.2.1. Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	**Schober's Test Week 1**	5.200	10	.7528	.2380
	Schober's Test Week 3	5.550	10	.7246	.2291
Pair 2	**Schober's Test Week 1**	5.200	10	.7528	.2380
	Schober's Test Week 6	5.850	10	.9144	.2892
Pair 3	**Schober's Test Week 3**	5.550	10	.7246	.2291
	Schober's Test Week 6	5.850	10	.9144	.2892
Pair 4	**Numerical Pain Scale Week 1**	52.00	10	11.353	3.590
	Numerical Pain Scale Week 3	41.00	10	25.144	7.951
Pair 5	**Numerical Pain Scale Week 1**	52.00	10	11.353	3.590
	Numerical Pain Scale Week 6	25.00	10	25.495	8.062
Pair 6	**Numerical Pain Scale Week 3**	41.00	10	25.144	7.951
	Numerical Pain Scale Week 6	25.00	10	25.495	8.062
Pair 7	**Oswestry Pain And Disability Questionnaire Week 1**	28.00	10	12.111	3.830
	Oswestry Pain And Disability Questionnaire Week 3	24.00	10	13.166	4.163
Pair 8	**Oswestry Pain And Disability Questionnaire Week 1**	28.00	10	12.111	3.830
	Oswestry Pain And Disability Questionnaire Week 6	13.40	10	11.433	3.615
Pair 9	**Oswestry Pain And Disability Questionnaire Week 3**	24.00	10	13.166	4.163

		Mean	N	Std. Deviation	Std. Error Mean
	Oswestry Pain And Disability Questionnaire Week 6	13.40	10	11.433	3.615

8.15.2.2. Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	**Schober's Test Week 1 & Schober's Test Week 3**	10	.947	.000
Pair 2	**Schober's Test Week 1 & Schober's Test Week 6**	10	.856	.002
Pair 3	**Schober's Test Week 3 & Schober's Test Week 6**	10	.935	.000
Pair 4	**Numerical Pain Scale Week 1 & Numerical Pain Scale Week 3**	10	.654	.040
Pair 5	**Numerical Pain Scale Week 1 & Numerical Pain Scale Week 6**	10	.653	.041
Pair 6	**Numerical Pain Scale Week 3 & Numerical Pain Scale Week 6**	10	.910	.000
Pair 7	**Oswestry Pain And Disability Questionnaire Week 1 & Oswestry Pain And Disability Questionnaire Week 3**	10	.758	.011
Pair 8	**Oswestry Pain And Disability Questionnaire Week 1 & Oswestry Pain And Disability Questionnaire Week 6**	10	.305	.392
Pair 9	**Oswestry Pain And Disability Questionnaire Week 3 & Oswestry Pain And Disability Questionnaire Week 6**	10	.635	.049

8.15.2.3. Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	**Schober's Test Week 1 - Schober's Test Week 3**	-.3500	.2415	.0764	-.5228	-.1772	-4.583	9	.001
Pair 2	**Schober's Test Week 1 - Schober's Test Week 6**	-.6500	.4743	.1500	-.9893	-.3107	-4.333	9	.002
Pair 3	**Schober's Test Week 3 - Schober's Test Week 6**	-.3000	.3496	.1106	-.5501	-.0499	-2.714	9	.024
Pair 4	**Numerical Pain Scale Week 1 - Numerical Pain Scale Week 3**	11.000	19.692	6.227	-3.087	25.087	1.766	9	.111

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 5	Numerical Pain Scale Week 1 - Numerical Pain Scale Week 6	27.000	20.028	6.333	12.673	41.327	4.263	9	.002
Pair 6	Numerical Pain Scale Week 3 - Numerical Pain Scale Week 6	16.000	10.750	3.399	8.310	23.690	4.707	9	.001
Pair 7	Oswestry Pain And Disability Questionnaire Week 1 - Oswestry Pain And Disability Questionnaire Week 3	4.000	8.844	2.797	-2.327	10.327	1.430	9	.186
Pair 8	Oswestry Pain And Disability Questionnaire Week 1 - Oswestry Pain And Disability Questionnaire Week 6	14.600	13.890	4.392	4.664	24.536	3.324	9	.009
Pair 9	Oswestry Pain And Disability Questionnaire Week 3 - Oswestry Pain And Disability Questionnaire Week 6	10.600	10.627	3.361	2.998	18.202	3.154	9	.012

8.15.2.4. Ranks

		N	Mean Rank	Sum of Ranks
Schober's Test Week 3 - Schober's Test Week 1	Negative Ranks	0(a)	.00	.00
	Positive Ranks	7(b)	4.00	28.00
	Ties	3(c)		
	Total	10		
Schober's Test Week 6 - Schober's Test Week 1	Negative Ranks	0	.00	.00
	Positive Ranks	8	4.50	36.00
	Ties	2		
	Total	10		
Schober's Test Week 6 - Schober's Test Week 3	Negative Ranks	0	.00	.00
	Positive Ranks	5	3.00	15.00

		N	Mean Rank	Sum of Ranks
	Ties	5		
	Total	10		
Numerical Pain Scale Week 3 - Numerical Pain Scale Week 1	**Negative Ranks**	7	5.07	35.50
	Positive Ranks	2	4.75	9.50
	Ties	1		
	Total	10		
Numerical Pain Scale Week 6 - Numerical Pain Scale Week 1	**Negative Ranks**	9	5.89	53.00
	Positive Ranks	1	2.00	2.00
	Ties	0		
	Total	10		
Numerical Pain Scale Week 6 - Numerical Pain Scale Week 3	**Negative Ranks**	8	4.50	36.00
	Positive Ranks	0	.00	.00
	Ties	2		
	Total	10		
Oswestry Pain And Disability Questionnaire Week 3 - Oswestry Pain And Disability Questionnaire Week 1	**Negative Ranks**	7	5.71	40.00
	Positive Ranks	3	5.00	15.00
	Ties	0		
	Total	10		
Oswestry Pain And Disability Questionnaire Week 6 - Oswestry Pain And Disability Questionnaire Week 1	**Negative Ranks**	9	5.94	53.50
	Positive Ranks	1	1.50	1.50
	Ties	0		
	Total	10		
Oswestry Pain And Disability Questionnaire Week 6 - Oswestry Pain And Disability Questionnaire Week 3	**Negative Ranks**	8	4.50	36.00
	Positive Ranks	0	.00	.00
	Ties	2		
	Total	10		
a Schober's Test Week 3 < Schober's Test Week 1				
b Schober's Test Week 3 > Schober's Test Week 1				
c Schober's Test Week 3 = Schober's Test Week 1				

8.15.2.5. Test Statistics(c)

	Z	Asymp. Sig. (2-tailed)
Schober's Test Week 3 - Schober's Test Week 1	-2.646(a)	.008
Schober's Test Week 6 - Schober's Test Week 1	-2.565(a)	.010
Schober's Test Week 6 - Schober's Test Week 3	-2.121(a)	.034
Numerical Pain Scale Week 3 - Numerical Pain Scale Week 1	-1.569(b)	.117
Numerical Pain Scale Week 6 - Numerical Pain Scale Week 1	-2.616(b)	.009
Numerical Pain Scale Week 6 - Numerical Pain Scale Week 3	-2.558(b)	.011
Oswestry Pain And Disability Questionnaire Week 3 - Oswestry Pain And Disability Questionnaire Week 1	-1.284(b)	.199
Oswestry Pain And Disability Questionnaire Week 6 - Oswestry Pain And Disability Questionnaire Week 1	-2.661(b)	.008
Oswestry Pain And Disability Questionnaire Week 6 - Oswestry Pain And Disability Questionnaire Week 3	-2.552(b)	.011
a Based on negative ranks.		
b Based on positive ranks.		
c Wilcoxon Signed Ranks Test		

8.15.3. Group C – Both

8.15.3.1. Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	**Schober's Test Week 1**	4.150	10	1.1068	.3500
	Schober's Test Week 3	5.200	10	1.0593	.3350
Pair 2	**Schober's Test Week 1**	4.150	10	1.1068	.3500
	Schober's Test Week 6	5.800	10	.9189	.2906
Pair 3	**Schober's Test Week 3**	5.200	10	1.0593	.3350
	Schober's Test Week 6	5.800	10	.9189	.2906
Pair 4	**Numerical Pain Scale Week 1**	45.00	10	14.530	4.595
	Numerical Pain Scale Week 3	30.50	10	17.393	5.500
Pair 5	**Numerical Pain Scale Week 1**	45.00	10	14.530	4.595
	Numerical Pain Scale Week 6	12.50	10	18.745	5.928
Pair 6	**Numerical Pain Scale Week 3**	30.50	10	17.393	5.500
	Numerical Pain Scale Week 6	12.50	10	18.745	5.928

		Mean	N	Std. Deviation	Std. Error Mean
Pair 7	Oswestry Pain And Disability Questionnaire Week 1	28.80	10	10.163	3.214
	Oswestry Pain And Disability Questionnaire Week 3	22.20	10	14.374	4.546
Pair 8	Oswestry Pain And Disability Questionnaire Week 1	28.80	10	10.163	3.214
	Oswestry Pain And Disability Questionnaire Week 6	12.40	10	13.786	4.359
Pair 9	Oswestry Pain And Disability Questionnaire Week 3	22.20	10	14.374	4.546
	Oswestry Pain And Disability Questionnaire Week 6	12.40	10	13.786	4.359

8.15.3.2. Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Schober's Test Week 1 & Schober's Test Week 3	10	.659	.038
Pair 2	Schober's Test Week 1 & Schober's Test Week 6	10	.497	.144
Pair 3	Schober's Test Week 3 & Schober's Test Week 6	10	.702	.024
Pair 4	Numerical Pain Scale Week 1 & Numerical Pain Scale Week 3	10	.780	.008
Pair 5	Numerical Pain Scale Week 1 & Numerical Pain Scale Week 6	10	.806	.005
Pair 6	Numerical Pain Scale Week 3 & Numerical Pain Scale Week 6	10	.805	.005
Pair 7	Oswestry Pain And Disability Questionnaire Week 1 & Oswestry Pain And Disability Questionnaire Week 3	10	.753	.012
Pair 8	Oswestry Pain And Disability Questionnaire Week 1 & Oswestry Pain And Disability Questionnaire Week 6	10	.898	.000
Pair 9	Oswestry Pain And Disability Questionnaire Week 3 & Oswestry Pain And Disability Questionnaire Week 6	10	.912	.000

8.15.3.3. Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Schober's Test Week 1 - Schober's Test Week 3	-1.0500	.8960	.2833	-1.6909	-.4091	-3.706	9	.005

		Paired Differences							
Pair 2	**Schober's Test Week 1 - Schober's Test Week 6**	-1.6500	1.0288	.3253	-2.3859	-.9141	-5.072	9	.001
Pair 3	**Schober's Test Week 3 - Schober's Test Week 6**	-.6000	.7746	.2449	-1.1541	-.0459	-2.449	9	.037
Pair 4	**Numerical Pain Scale Week 1 - Numerical Pain Scale Week 3**	14.500	10.916	3.452	6.691	22.309	4.200	9	.002
Pair 5	**Numerical Pain Scale Week 1 - Numerical Pain Scale Week 6**	32.500	11.118	3.516	24.547	40.453	9.244	9	.000
Pair 6	**Numerical Pain Scale Week 3 - Numerical Pain Scale Week 6**	18.000	11.353	3.590	9.879	26.121	5.014	9	.001
Pair 7	**Oswestry Pain And Disability Questionnaire Week 1 - Oswestry Pain And Disability Questionnaire Week 3**	6.600	9.477	2.997	-.180	13.380	2.202	9	.055
Pair 8	**Oswestry Pain And Disability Questionnaire Week 1 - Oswestry Pain And Disability Questionnaire Week 6**	16.400	6.450	2.040	11.786	21.014	8.041	9	.000
Pair 9	**Oswestry Pain And Disability Questionnaire Week 3 - Oswestry Pain And Disability Questionnaire Week 6**	9.800	5.922	1.873	5.564	14.036	5.233	9	.001

8.15.3.4. Ranks

		N	Mean Rank	Sum of Ranks
Schober's Test Week 3 - Schober's Test Week 1	**Negative Ranks**	0(a)	.00	.00
	Positive Ranks	8(b)	4.50	36.00
	Ties	2(c)		
	Total	10		
Schober's Test Week 6 - Schober's Test Week 1	**Negative Ranks**	1	1.00	1.00
	Positive Ranks	9	6.00	54.00
	Ties	0		
	Total	10		

		N	Mean Rank	Sum of Ranks
Schober's Test Week 6 - Schober's Test Week 3	**Negative Ranks**	1	4.50	4.50
	Positive Ranks	7	4.50	31.50
	Ties	2		
	Total	10		
Numerical Pain Scale Week 3 - Numerical Pain Scale Week 1	**Negative Ranks**	8	4.50	36.00
	Positive Ranks	0	.00	.00
	Ties	2		
	Total	10		
Numerical Pain Scale Week 6 - Numerical Pain Scale Week 1	**Negative Ranks**	10	5.50	55.00
	Positive Ranks	0	.00	.00
	Ties	0		
	Total	10		
Numerical Pain Scale Week 6 - Numerical Pain Scale Week 3	**Negative Ranks**	8	4.50	36.00
	Positive Ranks	0	.00	.00
	Ties	2		
	Total	10		
Oswestry Pain And Disability Questionnaire Week 3 - Oswestry Pain And Disability Questionnaire Week 1	**Negative Ranks**	7	6.43	45.00
	Positive Ranks	3	3.33	10.00
	Ties	0		
	Total	10		
Oswestry Pain And Disability Questionnaire Week 6 - Oswestry Pain And Disability Questionnaire Week 1	**Negative Ranks**	10	5.50	55.00
	Positive Ranks	0	.00	.00
	Ties	0		
	Total	10		
Oswestry Pain And Disability Questionnaire Week 6 - Oswestry Pain And Disability Questionnaire Week 3	**Negative Ranks**	10	5.50	55.00
	Positive Ranks	0	.00	.00
	Ties	0		
	Total	10		
a Schober's Test Week 3 < Schober's Test Week 1				
b Schober's Test Week 3 > Schober's Test Week 1				

		N	Mean Rank	Sum of Ranks
c Schober's Test Week 3 = Schober's Test Week 1				

8.15.3.5. Test Statistics(c)

	Z	Asymp. Sig. (2-tailed)
Schober's Test Week 3 - Schober's Test Week 1	-2.539(a)	.011
Schober's Test Week 6 - Schober's Test Week 1	-2.717(a)	.007
Schober's Test Week 6 - Schober's Test Week 3	-1.919(a)	.055
Numerical Pain Scale Week 3 - Numerical Pain Scale Week 1	-2.539(b)	.011
Numerical Pain Scale Week 6 - Numerical Pain Scale Week 1	-2.821(b)	.005
Numerical Pain Scale Week 6 - Numerical Pain Scale Week 3	-2.565(b)	.010
Oswestry Pain And Disability Questionnaire Week 3 - Oswestry Pain And Disability Questionnaire Week 1	-1.786(b)	.074
Oswestry Pain And Disability Questionnaire Week 6 - Oswestry Pain And Disability Questionnaire Week 1	-2.807(b)	.005
Oswestry Pain And Disability Questionnaire Week 6 - Oswestry Pain And Disability Questionnaire Week 3	-2.807(b)	.005
a Based on negative ranks.		
b Based on positive ranks.		
c Wilcoxon Signed Ranks Test		